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11  
12 UNITED STATES DISTRICT COURT  
13 NORTHERN DISTRICT OF CALIFORNIA  
14 SAN FRANCISCO DIVISION  
15

16 IN RE SEAGATE TECHNOLOGY, LLC  
LITIGATION

17  
18 CONSOLIDATED ACTION  
19  
20

Case No. 3:16-cv-00523 JCS

**DECLARATION OF KARL SCHWEISS  
IN SUPPORT OF SEAGATE  
TECHNOLOGY LLC'S OPPOSITION TO  
PLAINTIFFS' MOTION FOR CLASS  
CERTIFICATION**

1 I, Karl Schweiss, hereby declare as follows:

2 1. I am an employee of Seagate Technology LLC (“Seagate” or the  
3 “Company”). I have reviewed the documents discussed in my declaration and conferred with  
4 other employees at Seagate. I make the following statements based on my personal knowledge of  
5 Seagate’s practices and procedures and the results of my review and investigation. If called as a  
6 witness, I could and would competently testify thereto.

7 2. I joined Seagate in 1989, when the Company acquired the disk drive  
8 division of CDC Drives, for which I worked at the time. In 2001, I joined the Marketing and  
9 Communications Department as a Technical Writer. I am currently employed as a Senior  
10 Technical Writer. My duties remained the same in both roles but I am responsible for a higher  
11 volume of work in the senior position. My duties include: (1) drafting product manuals for core,  
12 desktop, enterprise, and notebook products, (2) maintaining and updating product manuals, and (3)  
13 working with customer support to ensure the most current version of each product manual is  
14 available on Seagate’s website.

15 3. I am based in Seagate’s facility in Oklahoma City, Oklahoma.

16 4. It is my understanding that Seagate hard drives with model ST3000DM001  
17 (the “Drives”) are at issue in this action. The Drives were marketed under numerous product  
18 names. The internal products (“Internal Products”) containing the Drives at issue are: Barracuda  
19 and Desktop HDD Internal Kit. The external products (“External Products”) containing the Drives  
20 at issue are: Backup Plus Desk, Backup Plus for Mac, Expansion Desk, Expansion Desk Plus,  
21 GoFlex Desk for Mac, FreeAgent GoFlex Home, FreeAgent GoFlex Desk, Business 1 Bay NAS,  
22 Business 2 Bay NAS, and Business 4 Bay NAS.

23 **Format of Draft and Finalized Product Manuals**

24 5. I am familiar with the format of finalized product manuals that are released  
25 to the public and the format of draft product manuals that are not released to the public. Released  
26 product manuals do not have redlines, while draft product manuals may have redlines.  
27 Additionally, the final version of a released product manual will only have an alphabetical  
28



1 character without numbers, while the draft version of a product manual may have numerical  
2 characters.

3 **Draft April 2011 Desktop HDD Product Manual**

4           6. I reviewed the document Plaintiffs refer to in their class certification motion  
5 with beginning Bates number FED\_SEAG0019045\_1, which I understand is a product manual for  
6 Seagate's Barracuda drives, including HDD model number ST3000DM001 dated April 2011 (the  
7 "April 2011 Draft Product Manual"). See Motion, 6:22-7:1. A true and correct copy of the April  
8 2011 Draft Product Manual is attached here as **Exhibit 1**.

9           7. I confirm the April 2011 Draft Product Manual is a draft that was never  
10 released to the public. The April 2011 Draft Product Manual, "Rev. A2," includes the number "2"  
11 and not solely alphabetical characters. Also, the April 2011 Draft Product Manual contains  
12 redlines on many of its pages. These redlines are indicated by vertical lines on the right-hand  
13 margins of these pages.

14           8. The Barracuda and Desktop HDD product manuals attached here as  
15 **Exhibits 2-16** are true and correct copies of all finalized and published product manuals for the  
16 Internal Products from January 2011 – February 2016.

17           9. The Barracuda was eventually rebranded as the Desktop HDD, as shown by  
18 the renaming of the Barracuda Product Manual to the Desktop HDD Product Manual in May 2014  
19 at Revision J. A true and correct copy is attached as **Exhibit 10**.

20 **AFR Representations in Product Manuals for Internal Products**

21           10. Based on my review of Exhibits 2–12, I can confirm that finalized product  
22 manuals for the Internal Products do not specify an Annualized Failure Rate (AFR) of less than  
23 1% based on 2,400 power on hours (POH) for the ST3000DM001 prior to January 2015.

24           11. Only after January 2015 did product manuals for the Internal Products  
25 specify an AFR of less than 1% based on 2,400 power on hours (POH) for the ST3000DM001  
26 HDDs. Page 20 of Exhibit 12, the finalized January 2015 product manual (FED\_SEAG0070909),  
27 includes such language for the ST3000DM001 for the first time.

28

1 Desktop HDD Data Sheets

2 12. **Exhibit 17** is a true and correct copy of a draft data sheet for the Desktop  
3 HDD. The draft data sheet shows edits indicating that references to AFR were removed on  
4 October 25, 2012.

5 13. **Exhibit 18** is a true and correct copy of a finalized data sheet for the  
6 Desktop HDD from December 2012 that shows AFR references no longer appeared in data sheets  
7 for the Desktop HDD as of that date. After a data sheet or product manual is finalized, there is a  
8 period of time during which old versions of these materials remain on Seagate's website until the  
9 updated version is made available.

10 **Product Manuals for External Products**

11 14. As a matter of practice at Seagate, product manuals for external products do  
12 not contain AFR representations or reference the ST number for the drive inside the product.  
13 Accordingly, product manuals for the External Products would not contain AFR representations or  
14 reference the ST3000DM001. Moreover, no product manuals for the External Products were ever  
15 published. This means the named plaintiffs who purchased the Backup Plus Desk and Backup  
16 Plus for Mac could not have: (1) viewed AFR representations for the Backup Plus Desk or Backup  
17 Plus for Mac in product manuals, or (2) determined the ST3000DM001 was inside these products  
18 after reviewing product manuals for the Backup Plus Desk or Backup Plus for Mac.

19 **Data Sheets for External Products**

20 15. As a matter of practice at Seagate, the data sheets for external products  
21 never reference the ST number for the internal drive. The ST number referred to in data sheets for  
22 external products pertains to the chassis or box number for the product. This means the data  
23 sheets for the External Products at issue here would not have referenced the ST3000DM001.

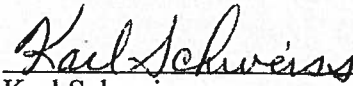
24 **Storage Solutions Guides**

25 16. The Storage Solutions Guides attached here as **Exhibits 19–27** are true and  
26 correct copies of all Storage Solutions Guides published for the United States from January 2011-  
27 February 2016.

28

1 I declare under penalty of perjury under the laws of the United States of America  
2 that the foregoing is true and correct.

3 Executed on this 5th day of January, 2018, at Oklahoma City, Oklahoma.

4  
5   
6 Karl Schweiss

# Exhibit 1



Product Manual

**Barracuda®**

ST3000DM001  
ST2500DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003

Gen 14  
100666115  
Rev. A2  
April 2011

## Document Revision History

Revision	Date	Description of Change
Rev. A1	03/18/2011	Initial release.
Rev. A2	4/21/2011	Updated specifications.

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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Seagate reserves the right to change, without notice, product offerings or specifications.

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# Seagate Technology Support Services

For information regarding online support and services, visit [http://www.seagate.com/www/en-us/about/contact\\_us/](http://www.seagate.com/www/en-us/about/contact_us/)

Available services include:

- Presales & Technical support
- Global Support Services telephone numbers & business hours
- Authorized Service Centers

For information regarding Warranty Support, visit [http://www.seagate.com/www/en-us/support/warranty & returns assistance](http://www.seagate.com/www/en-us/support/warranty_returns_assistance)

For information regarding data recovery services, visit <http://www.i365.com>

For Seagate OEM and Distribution partner portal, visit <https://direct.seagate.com/portal/system>

For Seagate reseller portal, visit <http://spp.seagate.com>



## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following Seagate Barracuda® model drives:

ST3000DM001	ST2000DM001	ST1000DM003
ST2500DM001	ST1500DM003	ST750DM003

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- Perpendicular recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queueing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 10% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors.
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

### 1.1 About the Serial ATA interface

The Serial ATA interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, Serial ATA makes the transition from parallel ATA easy by providing legacy software support. Serial ATA was designed to allow you to install a Serial ATA host adapter and Serial ATA disk drive in your current system and expect all of your existing applications to work as normal.

**Introduction**[www.seagate.com](http://www.seagate.com)

The Serial ATA interface connects each disk drive in a point-to-point configuration with the Serial ATA host adapter. There is no master/slave relationship with Serial ATA devices like there is with parallel ATA. If two drives are attached on one Serial ATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

**Note**

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate Serial ATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical Serial ATA environment.

The Serial ATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The Serial ATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All Serial ATA devices behave like Device 0 devices. For additional information about how Serial ATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

ST3000DM001	ST2000DM001	ST1000DM003
ST2500DM001	ST1500DM003	ST750DM003

### 2.1 Specification summary tables

The specifications listed in the following tables are for quick reference. For details on specification measurement or definition, see the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB and 2.5TB models**

Drive Specification	ST3000DM001	ST2500DM001
Formatted capacity (512 bytes/sector)*	3000GB (3TB)	2500GB ((2.5TB)
Guaranteed sectors	5,860,533,168	4,883,781,168
Heads	6	6
Disks	3	3
Bytes per sector	4096	4096
Default sectors per track	63	63
Default read/write heads	16	16
Default cylinders	16,383	16,383
Recording density (max)	1807kFCI	1807kFCI
Track density (avg)	352 ktracks/in	352 ktracks/in
Areal density (avg)	329 Gfc/in <sup>2</sup>	329 Gfc/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM
Internal data transfer rate (max)	2147Mb/s	2147Mb/s
Sustained data transfer rate OD (max)	159MB/s	159MB/s
I/O data-transfer rate (max)	600MB/s	600MB/s
ATA data-transfer modes supported	PIO modes: 0 to 4 Multiword DMA modes: 0 to 2 Ultra DMA modes: 0 to 6	
Cache buffer	64MB	64MB
Height (max.)	26.1mm / 1.028 in	26.1mm / 1.028 in
Width (max.)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max.)	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	622g / 1.371 lb	622g / 1.371 lb
Average latency	4.16ms	4.16ms
Power-on to ready (max.)	<10.0s	<10.0s
Standby to ready (max.)	<10.0s	<10.0s
Track-to-track seek time (typical)	<1.0ms read <1.2ms write	<1.0ms read <1.2ms write
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical	<8.5ms typical <9.5ms typical



## Drive Specifications

www.seagate.com

**Table 1 Drive specifications summary for 3TB and 2.5TB models (continued)**

Drive Specification	ST3000DM001	ST2500DM001
Startup current (typical) 12V (peak)	2.5A	2.5A
Voltage tolerance (including noise)	5V +10% / -7.5% 12V +10% / -7.5%	5V +10% / -7.5% 12V +10% / -7.5%
Ambient temperature	0° to 70°C (operating) -40° to 70°C (non-operating)	0° to 70°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max.)	30% per hour	30% per hour
Wet bulb temperature (max.)	37.7°C max (operating) 40.0°C max (non-operating)	37.7°C max (operating) 40.0°C max (non-operating)
Altitude, operating	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-304.8m to 3,048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max)	80 Gs at 2ms	80 Gs at 2ms
Non-Operational Shock (max)	300 Gs at 2ms	300 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs
Drive acoustics, sound power		
Idle**	2.4 bels (typical) 2.5 bels (max)	2.4 bels (typical) 2.5 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)	2.6 bels (typical) 2.7 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Annualized Failure Rate (AFR)	0.34%	0.34%
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.	
Load/Unload cycles (25°C, 50% rel. humidity)	300,000	300,000
Supports Hotplug operation per the Serial ATA Revision 2.5 specification	Yes	Yes

\*One GB equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.



**Table 2 Drive specifications summary for 2TB and 1.5TB models**

Drive Specification	ST2000DM001	ST1500DM003
Formatted capacity (512 bytes/sector)*	2000GB (2TB)	1500GB (1.5TB)
Guaranteed sectors	3,907,029,168	2,930,277,168
Heads	4	4
Disks	2	2
Bytes per sector	4096	4096
Default sectors per track	63	63
Default read/write heads	16	16
Default cylinders	16,383	16,383
Recording density (max.)	1807kFCI	1807kFCI
Track density (avg.)	352 ktracks/in	352 ktracks/in
Areal density (avg.)	625 Gfc/in <sup>2</sup>	625 Gfc/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM
Internal data transfer rate (max)	2147Mb/s	2147Mb/s
Sustained data transfer rate OD (max)	159MB/s	159MB/s
I/O data-transfer rate (max.)	600MB/s	600MB/s
ATA data-transfer modes supported	PIO modes: 0 to 4 Multiword DMA modes: 0 to 2 Ultra DMA modes: 0 to 6	PIO modes: 0 to 4 Multiword DMA modes: 0 to 2 Ultra DMA modes: 0 to 6
Cache buffer	64MB	64MB
Height (max.)	26.1mm / 1.028 in	26.1mm / 1.028 in
Width (max.)	101.6mm /4.0 in (± 0.010 in)	101.6mm /4.0 in (± 0.010 in)
Length (max.)	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	415g / 0.915 lb	415g / 0.915 lb
Average latency	4.16ms	4.16ms
Power-on to ready (max)	<8.5s	<8.5s
Standby to ready (max)	<8.5s	<8.5s
Track-to-track seek time (typical)	<1.0ms read; <1.2ms write	<1.0ms read; <1.2ms write
Average seek, read (typical)	<8.5ms	<8.5ms
Average seek, write (typical)	<9.5ms	<9.5ms
Startup current (typical) 12V (peak)	2.0A	2.0A
Voltage tolerance (including noise)	5V +10% / -7.5% 12V +10% / -7.5%	5V +10% / -7.5% 12V +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)
Altitude, operating	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-304.8m to 3,048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max)	80 Gs at 2ms	80 Gs at 2ms
Non-Operational Shock (max)	350 Gs at 2ms	350 Gs at 2ms

## Drive Specifications

www.seagate.com

**Table 2 Drive specifications summary for 2TB and 1.5TB models (continued)**

Drive Specification	ST2000DM001	ST1500DM003
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs
Drive acoustics, sound power		
Idle**	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)
Seek	2.4 bels (typical) 2.5 bels (max)	2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Annulized Failure Rate (AFR)	0.34%	0.34%
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> . From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.	
Load/Unload cycles (25°C, 50% rel. humidity)	300,000	300,000
Supports Hotplug operation per the Serial ATA Revision 2.5 specification	Yes	Yes

\*One GB equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 3 Drive specifications summary for 1TB and 750GB models**

Drive Specification	ST1000DM003	ST750DM003
Formatted capacity (512 bytes/sector)*	1000GB (1TB)	750GB
Guaranteed sectors	1,953,525,168	1,465,149,168
Heads	2	2
Disks	1	1
Bytes per sector	4096	4096
Default sectors per track	63	63
Default read/write heads	16	16
Default cylinders	16,383	16,383
Recording density (max.)	1807kFCI	1807kFCI
Track density (avg.)	352 ktracks/in	352 ktracks/in
Areal density (avg.)	625 Gfc/in <sup>2</sup>	625 Gfc/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM
Internal data transfer rate (max.)	2147 Mb/s	2147 Mb/s
Sustained data transfer rate OD (max.)	159 MB/s	159 MB/s
I/O data-transfer rate	600 MB/s	600 MB/s
ATA data-transfer modes supported	PIO modes: 0 to 4 Multiword DMA modes: 0 to 2 Ultra DMA modes: 0 to 6	PIO modes: 0 to 4 Multiword DMA modes: 0 to 2 Ultra DMA modes: 0 to 6
Cache buffer	64MB	64MB
Height (max.)	20.17mm / 0.7825 in	19.98mm / 0.787 in
Width (max.)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max.)	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	415g / 0.915 lb	415g / 0.915 lb

**Table 3 Drive specifications summary for 1TB and 750GB models (continued)**

Drive Specification	ST1000DM003	ST750DM003
Average latency	4.16ms	4.16ms
Power-on to ready (max.)	<8.5s	<8.5s
Standby to ready (max.)	<8.5s	<8.5s
Track-to-track seek time (typical)	<1.0ms (read) <1.2ms (write)	<1.0ms (read) <1.2ms (write)
Average seek, read (typical)	<8.5ms (read)	<8.5ms (read)
Average seek, write (typical)	<9.5ms (write)	<9.5ms (write)
Startup current (typical) 12V (peak)	2.0A	2.0A
Voltage tolerance (including noise)	5V +10% / -7.5% 12V +10% / -7.5%	5V +10% / -7.5% 12V +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient (max.)	20°C per hour (operating) 30°C per hour (non-operating)	20°C per hour (operating) 30°C per hour (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max.)	30% per hour	30% per hour
Wet bulb temperature	37.7°C max (operating) 40.0°C max (non-operating)	37.7°C max (operating) 40.0°C max (non-operating)
Altitude, operating	-60.96m to 3,048m (-1000 ft to 10,000+ ft)	-60.96m to 3,048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max.)	-60.96m to 12,192m (-1000 ft to 40,000+ ft)	-60.96m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max.)	80 Gs at 2ms	80 Gs at 2ms
Non-Operational Shock (max.)	350 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs
Drive acoustics, sound power		
Idle**	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)
Seek	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Annulized Failure Rate (AFR)	0.34%	0.34%
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> . From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.	
Load/Unload cycles (25°C, 50% rel. humidity)	300,000	300,000
Supports Hotplug operation per the Serial ATA Revision 2.5 specification	Yes	Yes

\*One GB equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.



## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001	3000GB	5,860,533,168	4096
ST2500DM001	2500GB	4,883,781,168	
ST2000DM001	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	

\*One GB equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

## 2.3 Default logical geometry

Cylinders	Read/write heads	Sectors per track
16,383	16	63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

Interface	Serial ATA (SATA)
Recording method	Perpendicular
Recording density (kFCI)	1807
Track density (ktracks/inch avg)	352
Areal density (Gfc/in <sup>2</sup> avg)	625
Spindle speed (RPM)	7200 ± 0.2%
Internal data transfer rate (Mb/s max)	2147
Sustained data transfer rate (MB/s max)	159
I/O data-transfer rate (MB/s max)	600

## 2.5 Physical characteristics

Maximum height	
3TB, 2.5TB, 2TB, 1.5TB	26.1mm / 1.028 in
1TB	20.17mm / 0.7825 in
750GB	19.98mm / 0.787 in
Maximum width (all models)	101.6mm / 4.0 in ( ± 0.010 in)
Maximum length (all models)	146.99mm / 5.787 in
Typical weight	
3TB, 2.5TB	622g / 1.371 lb
2TB, 1.5TB, 1TB, 750GB	415g/0.915 lb
Cache buffer	64MB (64,768kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5,000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

### Note

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	3-disk models	2-disk models	1-disk models
Power-on to Ready (typ / max sec)	<10	<8.5	<6
Standby to Ready (typ / max sec)	<10	<8.5	<6
Ready to spindle stop (typ / max sec)	<11	10	<10

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 30** on page 30.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 5 on page 20** and **Table 6 on page 20**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

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**Table 4 DC power requirements (3-disk)**

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.5 (peak)
Idle* †	6.4	—	—
Idle* † (with offline activity)	6.3	—	—
Operating	7.38	—	—
Standby	0.74	—	—
Sleep	0.74	—	—

**Table 5 DC power requirements (2/3-disk)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0 (peak)
Idle* †	5.9	—	—
Idle* † (with offline activity)	6.1	—	—
Operating	6.80	—	—
Standby	0.74	—	—
Sleep	0.74	—	—

**Table 6 DC power requirements (1-disk)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0 (peak)
Idle* †	4.8	—	—
Idle* † (with offline activity)	5.0	—	—
Operating	6.19	—	—
Standby	0.74	—	—
Sleep	0.74	—	—

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

<b>Note</b>	Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.
-------------	------------------------------------------------------------------------------------------------------------

## 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V +10% / -7.5%

12V +10% / -7.5%



## 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

### Active mode

The drive is in Active mode during the read/write and seek operations.

### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

### 2.9.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 69°C (156°F) within the operating ambient conditions.

Operating:	0° to 60°C (32° to 140°F)
Non-operating:	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

Operating:	20°C per hour (68°F per hour max), without condensation
Non-operating:	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

Operating:	5% to 95% non-condensing (30% per hour max)
Nonoperating:	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

Operating:	37.7°C (99.9°F max)
Non-operating:	40°C (104°F max)

### 2.9.4 Altitude

Operating:	–304.8 m to 3,048 m (–1000 ft. to 10,000+ ft.)
Non-operating:	–304.8 m to 12,192 m (–1000 ft. to 40,000+ ft.)

### 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

#### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

#### 2.9.5.2 Non-operating shock

##### 3TB and 2.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

**2TB, 1.5TB, 1TB and 750GB models**

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

**Vibration**

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis.

**2.9.5.3 Operating vibration**

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

**Non-operating vibration**

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

**2.10 Acoustics**

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note**

For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

(Number of seeks per second =  $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
3 Disks, 3TB and 2.5GB (ST3000DM001,ST2500DM001)	2.4 bels (typical) 2.5 bels (max)	2.6 bels (typical) 2.7 bels (max)
2 Disks, 2TB and 1.5TB models (ST2000DM001,ST1500DM003)	2.3 bels (typical) 2.4 bels (max)	2.5 bels (typical) 2.6 bels (max)
1 Disk, 1TB and 750GB models (ST1000DM003,ST750DM003)	2.2 bels (typical) 2.3 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.



## 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in the following **Table 8**:

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Reliability

The product shall achieve an Annualized Failure Rate (AFR) of 0.34% (MTBF of 0.75 million hours) when operated in an environment of ambient air temperatures of 25°C. Operation at temperatures outside the specifications in Section 2.9 may increase the product AFR (decrease MTBF). AFR and MTBF are population statistics that are not relevant to individual units.

AFR and MTBF specifications are based on the following assumptions for desktop personal computer environments:

2400 power-on-hours per year.

10,000 average motor start/stop cycles per year.

Operations at nominal voltages.

Temperatures outside the specifications in Section 2.9 may reduce the product reliability.

Normal I/O duty cycle for desktop personal computers. Operation at excessive I/O duty cycle may degrade product reliability.

The desktop personal computer environment of power-on-hours, temperature, and I/O duty cycle affect the product AFR and MTBF. The AFR and MTBF will be degraded if used in an enterprise application.

Nonrecoverable read errors	1 per $10^{14}$ bits read, max
Annualized Failure Rate (AFR)	0.34% (nominal power, 25°C ambient temperature)
Load/Unload cycles (25°C, 50% rel. humidity)	300,000
Preventive maintenance	None required.

## 2.13 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:

[support.seagate.com/customer/warranty\\_validation.jsp](http://support.seagate.com/customer/warranty_validation.jsp)

From this page, click on the “Verify Your Warranty” link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.

## 2.14 Agency certification

### 2.14.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.14.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

#### Korean RRL

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda 7200.14

Certificate number: in progress

#### Australian C-Tick (N176)

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

### 2.14.3 FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.



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This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

## 2.15 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

### 2.15.1 European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

### 2.15.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements 有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

## 2.16 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.





## 3.0 Configuring and Mounting the Drive

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This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

- Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.
- Handle the drive by its edges or frame *only*.
- The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.
- Always rest the drive on a padded, antistatic surface until you mount it in the computer.
- Do not touch the connector pins or the printed circuit board.
- Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the Serial ATA interface connects point-to-point with the Serial ATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one Serial ATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

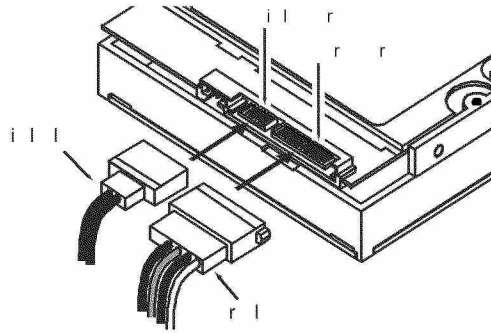
Serial ATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if you connect the drive and receive a “drive not detected” error, your SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

### 3.3 Serial ATA cables and connectors

The Serial ATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See **Table 9** for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, you can connect the drive as illustrated in **Figure 1**.

**Figure 1** Attaching SATA cabling

Each cable is keyed to ensure correct orientation. Barracuda drives support latching SATA connectors.

### 3.4 Drive mounting

You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See **Figure 2** and **Figure 3** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

Use only 6-32 UNC mounting screws.

The screws should be inserted no more than 0.150 inch (3.81 mm) into the bottom or side mounting holes.

Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

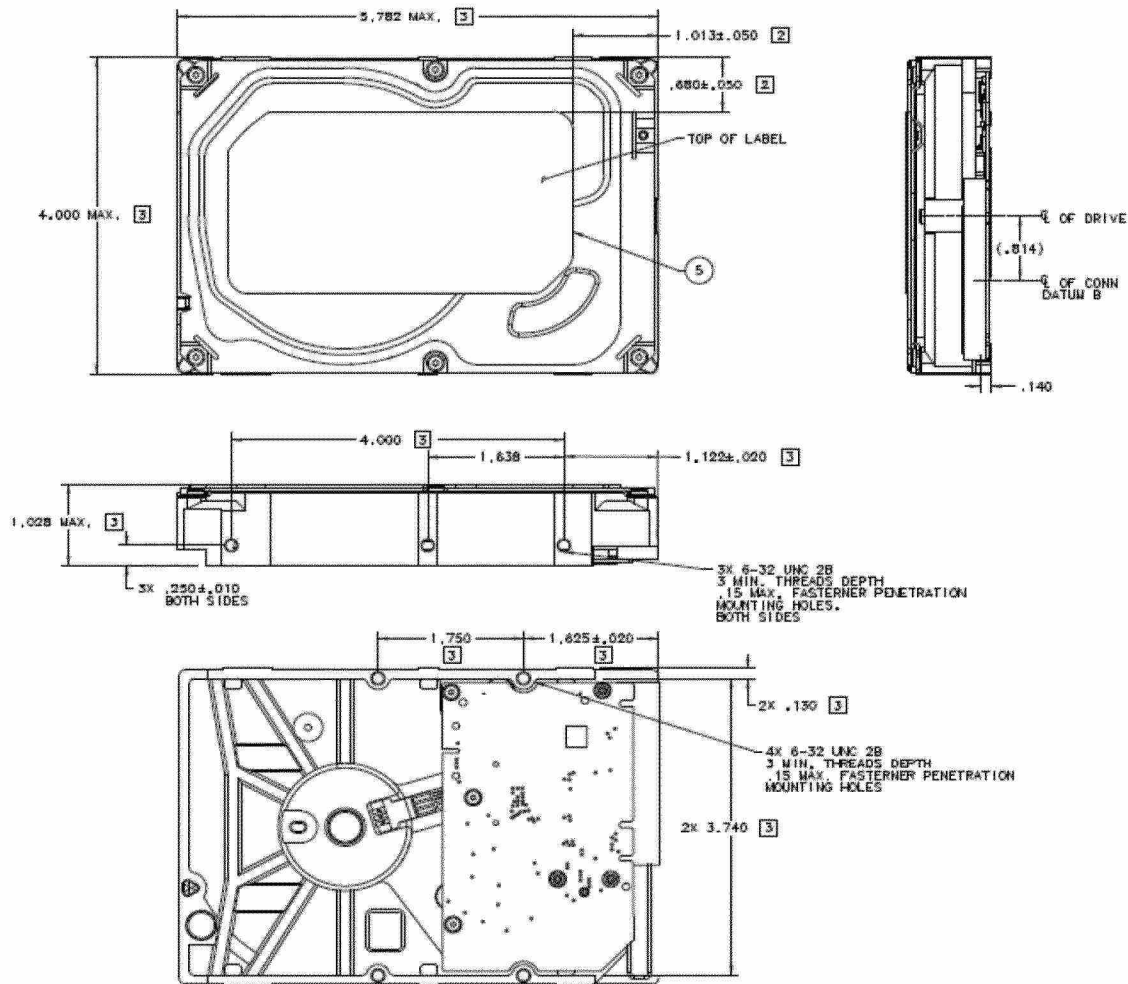
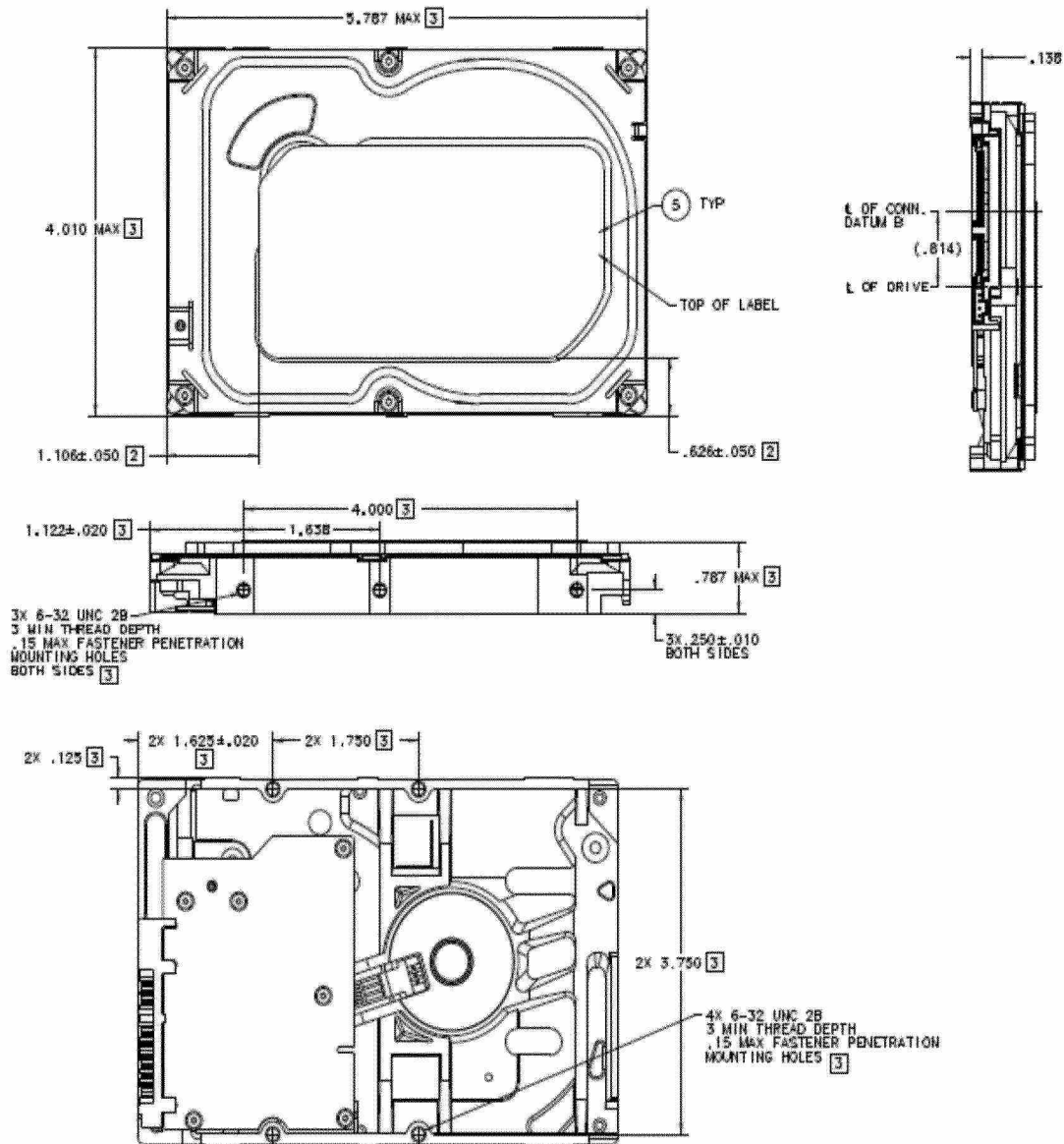
**Figure 2 Mounting dimensions ( 3/2-disk: 3TB, 2.5TB, 2TB, 1.5TB models)**

Figure 3 Mounting dimensions (1-Disk: 1TB and 750GB models)





## 4.0 Serial ATA (SATA) Interface

These drives use the industry-standard Serial ATA interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the Serial ATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 4.1 Hot-Plug compatibility

Barracuda drives incorporate connectors which enable you to hot plug these drives in accordance with the Serial ATA Revision 2.5 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 4.2 Serial ATA device plug connector pin definitions

**Table 9** summarizes the signals on the Serial ATA interface and power connectors.

**Table 9** Serial ATA connector pin definitions

Segment	Pin	Function	Definition
	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
Signal	S7	Ground	2nd mate
Key and spacing separate signal and power segments			



**Table 9 Serial ATA connector pin definitions**

Segment	Pin	Function	Definition
<b>Power</b>	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

**Notes**

- All pins are in a single row, with a 1.27 mm (0.050") pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.  
All used voltage pins (V<sub>x</sub>) must be terminated.

**4.3 Supported ATA commands**

The following table lists Serial ATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 2.6 (<http://www.sata-io.org>).

See "S.M.A.R.T. commands" on page 42 for details and subcommands used in the S.M.A.R.T. implementation.

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>

Command name	Command code (in hex)
Device Reset	08 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>

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Command name	Command code (in hex)
Set Max Address  Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	F9 <sub>H</sub>  Address: 00 <sub>H</sub> Password: 01 <sub>H</sub> Lock: 02 <sub>H</sub> Unlock: 03 <sub>H</sub> Freeze Lock: 04 <sub>H</sub>
Set Max Address Extended	37 <sub>H</sub>
Set Multiple Mode	C6 <sub>H</sub>
Sleep	E6 <sub>H</sub>
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>
Standby	E2 <sub>H</sub>
Standby Immediate	E0 <sub>H</sub>
Write Buffer	E8 <sub>H</sub>
Write DMA	CA <sub>H</sub>
Write DMA Extended	35 <sub>H</sub>
Write DMA FUA Extended	3D <sub>H</sub>
Write DMA Without Retries	CB <sub>H</sub>
Write Log Extended	3F <sub>H</sub>
Write Multiple	C5 <sub>H</sub>
Write Multiple Extended	39 <sub>H</sub>
Write Multiple FUA Extended	CE <sub>H</sub>
Write Sectors	30 <sub>H</sub>
Write Sectors Without Retries	31 <sub>H</sub>
Write Sectors Extended	34 <sub>H</sub>
Write Uncorrectable	45 <sub>H</sub>

### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 34. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the Serial ATA specification.

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>



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Word	Description	Value
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100-103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	Serial ATA capabilities	xxxx <sub>H</sub>
77	Reserved for future Serial ATA definition	xxxx <sub>H</sub>
78	Serial ATA features supported	xxxx <sub>H</sub>
79	Serial ATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>



Word	Description	Value
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFF <sub>H</sub> .	ST3000DM001 = 1,953,525,168 ST2500DM001 = 1,465,149,168 ST2000DM001 = 976,773,168 ST1500DM003 = 625,142,448 ST1000DM003 = 488,397,168 ST750DM003 = 312,581,808
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

<b>Note</b>	Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.
-------------	-----------------------------------------------------------------------------------------------------

<b>Note</b>	See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.
-------------	-------------------------------------------------------------------------------------

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.

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	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.
	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	Bit	Word 88
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
	00 <sub>H</sub> Set PIO mode to default (PIO mode 2).
	01 <sub>H</sub> Set PIO mode to default and disable IORDY (PIO mode 2).
	08 <sub>H</sub> PIO mode 0
	09 <sub>H</sub> PIO mode 1
	0A <sub>H</sub> PIO mode 2
	0B <sub>H</sub> PIO mode 3
	0C <sub>H</sub> PIO mode 4 ( <i>default</i> )
	20 <sub>H</sub> Multiword DMA mode 0
	21 <sub>H</sub> Multiword DMA mode 1
	22 <sub>H</sub> Multiword DMA mode 2
	40 <sub>H</sub> Ultra DMA mode 0
	41 <sub>H</sub> Ultra DMA mode 1
	42 <sub>H</sub> Ultra DMA mode 2
	43 <sub>H</sub> Ultra DMA mode 3
	44 <sub>H</sub> Ultra DMA mode 4
	45 <sub>H</sub> Ultra DMA mode 5
	46 <sub>H</sub> Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note**

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 4.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at:

<http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

**Note**

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.

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## Exhibit 2

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Product Manual

# Barracuda<sup>®</sup>

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

Gen 14  
100686584  
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One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Seagate reserves the right to change, without notice, product offerings or specifications.



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# Seagate Technology Support Services

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For information regarding data recovery services, visit <http://www.i365.com>

For Seagate OEM and Distribution partner portal, visit <https://direct.seagate.com/portal/system>

For Seagate reseller portal, visit <http://spp.seagate.com>





## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following Seagate Barracuda® model drives:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

These drives provide the following key features:

- 7200 RPM spindle speed.

- High instantaneous (burst) data-transfer rates (up to 600MB per second).

- TGMR recording technology provides the drives with increased areal density.

- State-of-the-art cache and on-the-fly error-correction algorithms.

- Native Command Queueing with command ordering to increase performance in demanding applications.

- Full-track multiple-sector transfer capability without local processor intervention.

- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.

- Seagate OptiCache™ technology boosts overall performance by as much as 10% over the previous generation.

- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors
- Quiet operation.

- Compliant with RoHS requirements in China and Europe.

- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.

- Support for S.M.A.R.T. drive monitoring and reporting.

- Supports latching SATA cables and connectors.

- Worldwide Name (WWN) capability uniquely identifies the drive.

### 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.

- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.

- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow you to install a SATA host adapter and SATA disk drive in your current system and expect all of your existing applications to work as normal.

**Introduction**[www.seagate.com](http://www.seagate.com)

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

**Note**

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001	ST2000DM001 ST1500DM003	ST1000DM003 ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1807kFCI	1807kFCI	1807kFCI
Track density (avg)	352ktracks/in	352ktracks/in	352ktracks/in
Areal density (avg)	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	2147Mb/s	2147Mb/s	2147 Mb/s
Average data rate, read/write (MB/s)	159MB/s	159MB/s	159MB/s
Maximum sustained data rate, OD read (MB/s)	210MB/s	210MB/s	210MB/s
I/O data-transfer rate (max)	600MB/s	600MB/s	600 MB/s
Cache buffer	64MB	64MB	64MB
Height (max)	26.1mm / 1.028 in	26.1mm / 1.028 in	20.17mm / 0.7825 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<17.0s	<17.0s	<10.0s

## Drive Specifications

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**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001	ST2000DM001 ST1500DM003	ST1000DM003 ST750DM003
Standby to ready (max)	<17.0s	<17.0s	<10.0s
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical	<8.5ms (read) <9.5ms (write)	<8.5ms (read) <9.5ms (write)
Startup current (typical) 12V (peak)	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: +10% / -5.0% 12V: +10% / -7.5%	5V: +10% / -5.0% 12V: +10% / -7.5%	5V: +10% / -5.0% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C max (operating) 40.0°C max (non-operating)
Altitude, operating	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-60.96m to 3,048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-60.96m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max)	80 Gs at 2ms	80 Gs at 2ms	80 Gs at 2ms
Non-Operational Shock (max)	300 Gs at 2ms	300 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs
Drive acoustics, sound power Idle*** Seek	2.4 bels (typical) 2.5 bels (max) 2.6 bels (typical) 2.7 bels (max)	2.3 bels (typical) 2.4 bels (max) 2.4 bels (typical) 2.5 bels (max)	2.2 bels (typical) 2.3 bels (max) 2.3 bels (typical) 2.4 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> . From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000	300,000	300,000
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.



**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2	2	1
Disks	1	1	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1413kb/in	1413kb/in	1413kb/in
Track density (avg)	236ktracks/in	236ktracks/in	236ktracks/in
Areal density (avg)	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	1695Mb/s	1695Mb/s	1695Mb/s
Average Data Rate, read/write (MB/s)	125MB/s	125MB/s	125MB/s
Maximum sustained data transfer rate, OD read (MB/s)	144MB/s	144MB/s	144MB/s
I/O data-transfer rate (max.)	600MB/s	600MB/s	600MB/s
Cache buffer	16MB	16MB	16MB
Height (max)	19.98mm / 0.787 in	19.98mm / 0.787 in	19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	415g / 0.915 lb	415g / 0.915 lb	415g / 0.915 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<8.5s	<8.5s	<8.5s
Standby to ready (max)	<8.5s	<8.5s	<8.5s
Average seek, read (typical)	<8.5ms (read)	<8.5ms (read)	<8.5ms (read)
Average seek, write (typical)	<9.5ms (write)	<9.5ms (write)	<9.5ms (write)
Startup current (typical) 12V (peak)	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: +10% / -5.0% 12V: +10% / -7.5%	5V: +10% / -5.0% 12V: +10% / -7.5%	5V: +10% / -5.0% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)
Altitude, operating	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-304.8m to 3,048m (-1000 ft to 10,000+ ft)

## Drive Specifications

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**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Altitude, non-operating (below mean sea level, max)	–304.8m to 12,192m (–1000 ft to 40,000+ ft)	–304.8m to 12,192m (–1000 ft to 40,000+ ft)	–304.8m to 12,192m (–1000 ft to 40,000+ ft)
Operational Shock (max)	70 Gs at 2ms	70 Gs at 2ms	70 Gs at 2ms
Non-Operational Shock (max)	350 Gs at 2ms	350 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)
Seek	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> . From this page, click on the “Verify Your Warranty” link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001	3000GB	5,860,533,168	4k
ST2000DM001	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

## 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

## 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	159
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600

## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 1.5TB and 2TB	26.1mm / 1.028 in
1TB and 750GB	20.17mm / 0.7825 in
500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in ( ± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB	626g / 1.38 lb
2TB and 1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

<b>Typical seek times (ms)</b>	<b>Read</b>	<b>Write</b>
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

### Note

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	<b>3-disk</b> (3TB model)	<b>2-disk</b> (2TB and 1.5TB models)	<b>1-disk</b> (1TB, 750GB, 500GB, 320GB, 250GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	8.5 (typical) 10 (max)
Standby to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1** on page 26.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3**, **Table 4**, **Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB)**

<b>Power dissipation (3-disk values shown)</b>	<b>Avg (watts 25° C)</b>	<b>Avg 5V typ amps</b>	<b>Avg 12V typ amps</b>
Spinup	—	—	2.0 (peak)
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005



**Table 4 DC power requirements (2-disk: 2TB and 1.5)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0 (peak)
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0 (peak)
Idle2* †	3.36	0.152	0.006
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk 500, 320 and 250GB)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0 (peak)
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

### Note

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

### 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V

+10% / -5%

12V

+10% / -7.5%

### 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

#### Active mode

The drive is in Active mode during the read/write and seek operations.

#### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

#### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

### 2.9.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 69°C (156°F) within the operating ambient conditions. Refer to **Section 3.4 on page 26** for base plate measurement location.

<b>Operating</b>	0° to 60°C (32° to 140°F)
<b>Non-operating</b>	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

<b>Operating</b>	20°C per hour (68°F per hour max), without condensation
<b>Non-operating</b>	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

<b>Operating</b>	5% to 95% non-condensing (30% per hour max)
<b>Nonoperating</b>	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

<b>Operating</b>	37.7°C (99.9°F max)
<b>Non-operating</b>	40°C (104°F max)

### 2.9.4 Altitude

<b>Operating</b>	–304.8m to 3,048m (–1000 ft. to 10,000+ ft.)
<b>Non-operating</b>	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

### 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

#### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

#### 2.9.5.2 Non-operating shock

##### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

**1TB, 750GB, 500GB, 320GB and 250GB models**

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

**2.9.5.3 Operating vibration**

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

**2.9.6 Non-operating vibration**

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

**2.10 Acoustics**

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note**

For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

(Number of seeks per second =  $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB )	2.4 bels (typical) 2.5 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (2TB and 1.5TB)	2.3 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)
<b>1 Disk</b> (1TB, 750GB, 500GB, 320GB, 250GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in Table 8.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:  
[support.seagate.com/customer/warranty\\_validation.jsp](http://support.seagate.com/customer/warranty_validation.jsp)

From this page, click on the “Verify Your Warranty” link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.

## 2.13 Agency certification

### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.



**Korean RRL**

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

**Australian C-Tick (N176)**

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

**2.13.3FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

**2.14 Environmental protection**

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

**2.14.1European Union Restriction of Hazardous Substances (RoHS) Directive**

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

**2.14.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令**

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

**2.15 Corrosive environment**

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

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This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until you mount it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

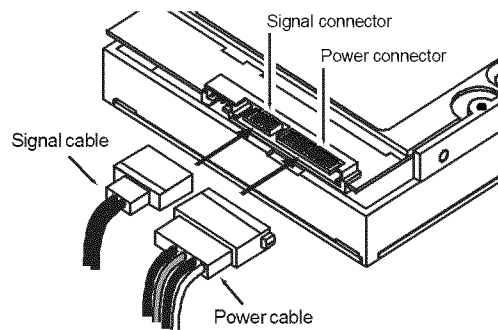
SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if you connect the drive and receive a “drive not detected” error, your SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See [Table 9](#) for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, you can connect the drive as illustrated in [Figure 1](#).

**Figure 1 Attaching SATA cabling**

Each cable is keyed to ensure correct orientation. Barracuda drives support latching SATA connectors.

### 3.4 Drive mounting

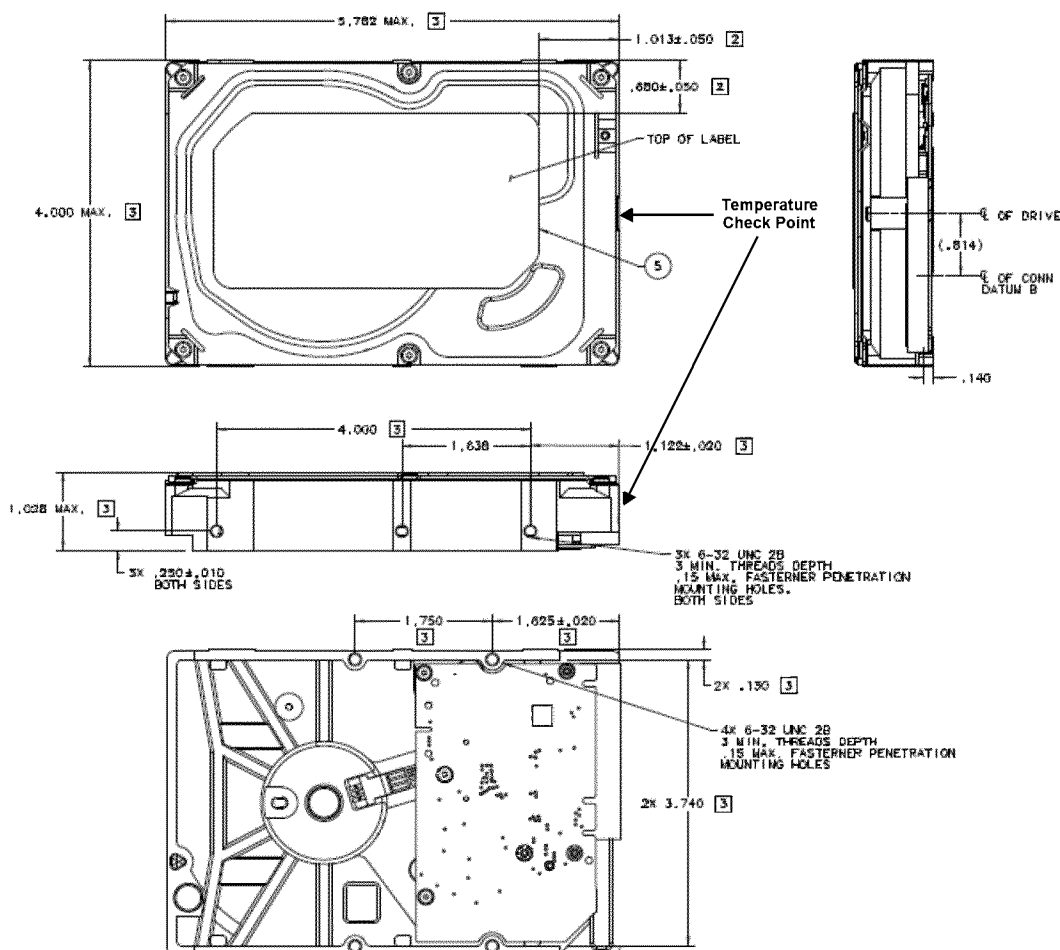
You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See **Figure 2** and **Figure 3** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

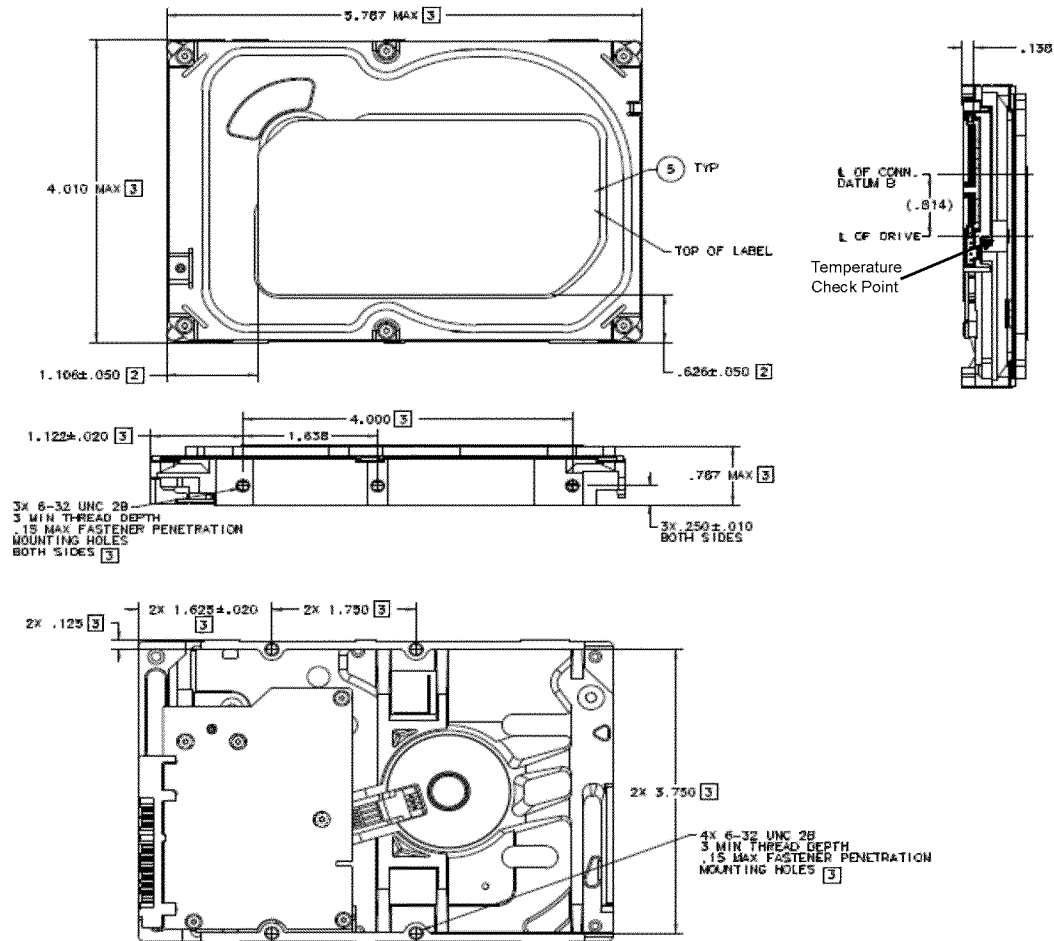
Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

Use only 6-32 UNC mounting screws.

The screws should be inserted no more than 0.150 inch (3.81 mm) into the bottom or side mounting holes.

Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2 Mounting dimensions (3-disk: 3TB / 2-disk: 2TB and 1.5TB models)**

**Figure 3 Mounting dimensions (1-disk: 1TB, 750GB, 500GB, 320GB and 250GB models)**





## 4.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 4.1 Hot-Plug compatibility

Barracuda drives incorporate connectors which enable you to hot plug these drives in accordance with the SATA Revision 3.0 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 4.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATA connector pin definitions

Segment	Pin	Function	Definition
	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
<b>Signal</b>	S7	Ground	2nd mate
Key and spacing separate signal and power segments			

**Table 9 SATA connector pin definitions**

Segment	Pin	Function	Definition
<b>Power</b>	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

**Notes**

- All pins are in a single row, with a 1.27 mm (0.050") pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
  - All used voltage pins (V<sub>x</sub>) must be terminated.

**4.3 Supported ATA commands**

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See "S.M.A.R.T. commands" on page 37 for details and subcommands used in the S.M.A.R.T. implementation.

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>

Command name	Command code (in hex)
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address	F9 <sub>H</sub>

Command name	Command code (in hex)	
	Address:	00 <sub>H</sub>
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Password:	01 <sub>H</sub>
	Lock:	02 <sub>H</sub>
	Unlock:	03 <sub>H</sub>
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S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>	
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>	
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>	
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Write DMA	CA <sub>H</sub>	
Write DMA Extended	35 <sub>H</sub>	
Write DMA FUA Extended	3D <sub>H</sub>	
Write DMA Without Retries	CB <sub>H</sub>	
Write Log Extended	3F <sub>H</sub>	
Write Multiple	C5 <sub>H</sub>	
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Write Multiple FUA Extended	CE <sub>H</sub>	
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Write Uncorrectable	45 <sub>H</sub>	

### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 30. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>



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Word	Description	Value
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>

Word	Description	Value
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFF <sub>H</sub> .	ST3000DM001 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

<b>Note</b>	Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.
-------------	-----------------------------------------------------------------------------------------------------

<b>Note</b>	See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.
-------------	-------------------------------------------------------------------------------------

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.

	5	GPL feature set is supported.
	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
	00 <sub>H</sub> Set PIO mode to default (PIO mode 2).
	01 <sub>H</sub> Set PIO mode to default and disable IORDY (PIO mode 2).
	08 <sub>H</sub> PIO mode 0
	09 <sub>H</sub> PIO mode 1

	0A <sub>H</sub> PIO mode 2
	0B <sub>H</sub> PIO mode 3
	0C <sub>H</sub> PIO mode 4 ( <i>default</i> )
	20 <sub>H</sub> Multiword DMA mode 0
	21 <sub>H</sub> Multiword DMA mode 1
	22 <sub>H</sub> Multiword DMA mode 2
	40 <sub>H</sub> Ultra DMA mode 0
	41 <sub>H</sub> Ultra DMA mode 1
	42 <sub>H</sub> Ultra DMA mode 2
	43 <sub>H</sub> Ultra DMA mode 3
	44 <sub>H</sub> Ultra DMA mode 4
	45 <sub>H</sub> Ultra DMA mode 5
	46 <sub>H</sub> Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note**

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 4.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)

Code in features register	S.M.A.R.T. command
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

**Note**

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.

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## Exhibit 3



Product Manual

# Barracuda®

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

Gen 14  
100686584  
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For Seagate OEM and Distribution partner portal, visit <https://direct.seagate.com/portal/system>

For Seagate reseller portal, visit <http://spp.seagate.com>



## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following Seagate Barracuda® model drives:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queueing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors.
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

### 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow you to install a SATA host adapter and SATA disk drive in your current system and expect all of your existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

**Introduction**[www.seagate.com](http://www.seagate.com)

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

**Note**

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

ST3000DM001      ST2000DM001      ST1500DM003      ST1000DM003  
ST750DM003      ST500DM002      ST320DM000      ST250DM000

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001 ST2000DM001	ST1500DM003	ST1000DM003 ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168 3,907,029,168	2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1807kFCI	1807kFCI	1807kFCI
Track density (avg)	352ktracks/in	352ktracks/in	352ktracks/in
Areal density (avg)	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	2147Mb/s	2147Mb/s	2147 Mb/s
Average data rate, read/write (MB/s)	156MB/s	156MB/s	156MB/s
Maximum sustained data rate, OD read (MB/s)	210MB/s	210MB/s	210MB/s
I/O data-transfer rate (max)	600MB/s	600MB/s	600 MB/s
Cache buffer	64MB	64MB	64MB
Height (max)	26.1mm / 1.028 in	26.1mm / 1.028 in	20.17mm / 0.7825 in
Width (max)	101.6mm /4.0 in (± 0.010 in)	101.6mm /4.0 in (± 0.010 in)	101.6mm / 4.0 in ( ± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	626g /1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<17.0s	<17.0s	<10.0s
Standby to ready (max)	<17.0s	<17.0s	<10.0s

## Drive Specifications

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**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001 ST2000DM001	ST1500DM003	ST1000DM003 ST750DM003
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical	<8.5ms (read) <9.5ms (write)	<8.5ms (read) <9.5ms (write)
Startup current (typical) 12V	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: +10% / -5.0% 12V: +10% / -7.5%	5V: +10% / -5.0% 12V: +10% / -7.5%	5V: +10% / -5.0% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C max (operating) 40.0°C max (non-operating)
Altitude, operating	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-304.8m to 3,048m15 (-1000 ft to 10,000+ ft)	-60.96m to 3,048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-60.96m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max)	80 Gs at 2ms	80 Gs at 2ms	80 Gs at 2ms
Non-Operational Shock (max)	300 Gs at 2ms	300 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs
Drive acoustics, sound power			
Idle***	ST3000DM001 and ST2000DM001 2.4 bels (typical) 2.6 bels (max)	ST1500DM003 2.4 bels (typical) 2.6 bels (max)	ST1000DM003 and ST750DM003 2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)	2.6 bels (typical) 2.7 bels (max)	2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000	300,000	300,000
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.



**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2	2	1
Disks	1	1	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1413kb/in	1413kb/in	1413kb/in
Track density (avg)	236ktracks/in	236ktracks/in	236ktracks/in
Areal density (avg)	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	1695Mb/s	1695Mb/s	1695Mb/s
Average Data Rate, read/write (MB/s)	125MB/s	125MB/s	125MB/s
Maximum sustained data transfer rate, OD read (MB/s)	144MB/s	144MB/s	144MB/s
I/O data-transfer rate (max.)	600MB/s	600MB/s	600MB/s
Cache buffer	16MB	16MB	16MB
Height (max)	19.98mm / 0.787 in	19.98mm / 0.787 in	19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	415g / 0.915 lb	415g / 0.915 lb	415g / 0.915 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<8.5s	<8.5s	<8.5s
Standby to ready (max)	<8.5s	<8.5s	<8.5s
Average seek, read (typical)	<8.5ms (read)	<8.5ms (read)	<8.5ms (read)
Average seek, write (typical)	<9.5ms (write)	<9.5ms (write)	<9.5ms (write)
Startup current (typical) 12V	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: +10% / -5.0% 12V: +10% / -7.5%	5V: +10% / -5.0% 12V: +10% / -7.5%	5V: +10% / -5.0% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)
Altitude, operating	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-304.8m to 3,048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max)	70 Gs at 2ms	70 Gs at 2ms	70 Gs at 2ms

## Drive Specifications

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**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Non-Operational Shock (max)	350 Gs at 2ms	350 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)
Seek	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> . From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001	3000GB	5,860,533,168	4k
ST2000DM001	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

## 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600

## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB and 750GB	20.17mm / 0.7825 in
500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in ( ± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

### Note

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	<b>3-disk</b> (3TB, 2TB models)	<b>2-disk</b> (1.5TB model)	<b>1-disk</b> (1TB, 750GB models)	<b>1-disk</b> (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Standby to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1** on page 26.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3**, **Table 4**, **Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

<b>Power dissipation (3-disk values shown)</b>	<b>Avg (watts 25° C)</b>	<b>Avg 5V typ amps</b>	<b>Avg 12V typ amps</b>
Spinup	—	—	2.0
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4 DC power requirements (2-disk: 1.5TB model)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.006
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

### Note

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

### 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V

+10% / -5%

12V

+10% / -7.5%

### 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

#### Active mode

The drive is in Active mode during the read/write and seek operations.

#### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

#### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.



## 2.9 Environmental specifications

### 2.9.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 69°C (156°F) within the operating ambient conditions. Refer to **Section 3.4 on page 26** for base plate measurement location.

<b>Operating</b>	0° to 60°C (32° to 140°F)
<b>Non-operating</b>	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

<b>Operating</b>	20°C per hour (68°F per hour max), without condensation
<b>Non-operating</b>	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

<b>Operating</b>	5% to 95% non-condensing (30% per hour max)
<b>Nonoperating</b>	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

<b>Operating</b>	37.7°C (99.9°F max)
<b>Non-operating</b>	40°C (104°F max)

### 2.9.4 Altitude

<b>Operating</b>	–304.8m to 3,048m (–1000 ft. to 10,000+ ft.)
<b>Non-operating</b>	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

### 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

#### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

#### 2.9.5.2 Non-operating shock

##### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

**1TB, 750GB, 500GB, 320GB and 250GB models**

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

**2.9.5.3 Operating vibration**

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

**2.9.6 Non-operating vibration**

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

**2.10 Acoustics**

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note**

For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

$$(\text{Number of seeks per second} = 0.4 / (\text{average latency} + \text{average access time}))$$

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (1.5TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in Table 8.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:  
[support.seagate.com/customer/warranty\\_validation.jsp](http://support.seagate.com/customer/warranty_validation.jsp)

From this page, click on the “Verify Your Warranty” link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.

## 2.13 Agency certification

### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

**Korean RRL**

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

**Australian C-Tick (N176)**

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

**2.13.3FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

**2.14 Environmental protection**

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

**2.14.1European Union Restriction of Hazardous Substances (RoHS) Directive**

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

## 2.14.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

## 2.15 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

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This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until you mount it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if you connect the drive and receive a “drive not detected” error, your SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

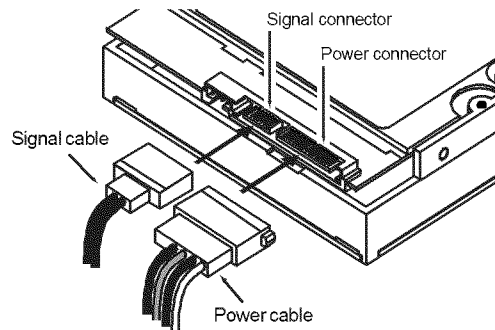
### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See [Table 9](#) for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, you can connect the drive as illustrated in [Figure 1](#).

**Figure 1 Attaching SATA cabling**



Each cable is keyed to ensure correct orientation. Barracuda drives support latching SATA connectors.

### 3.4 Drive mounting

You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2**, **Figure 3**, and **Figure 4** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

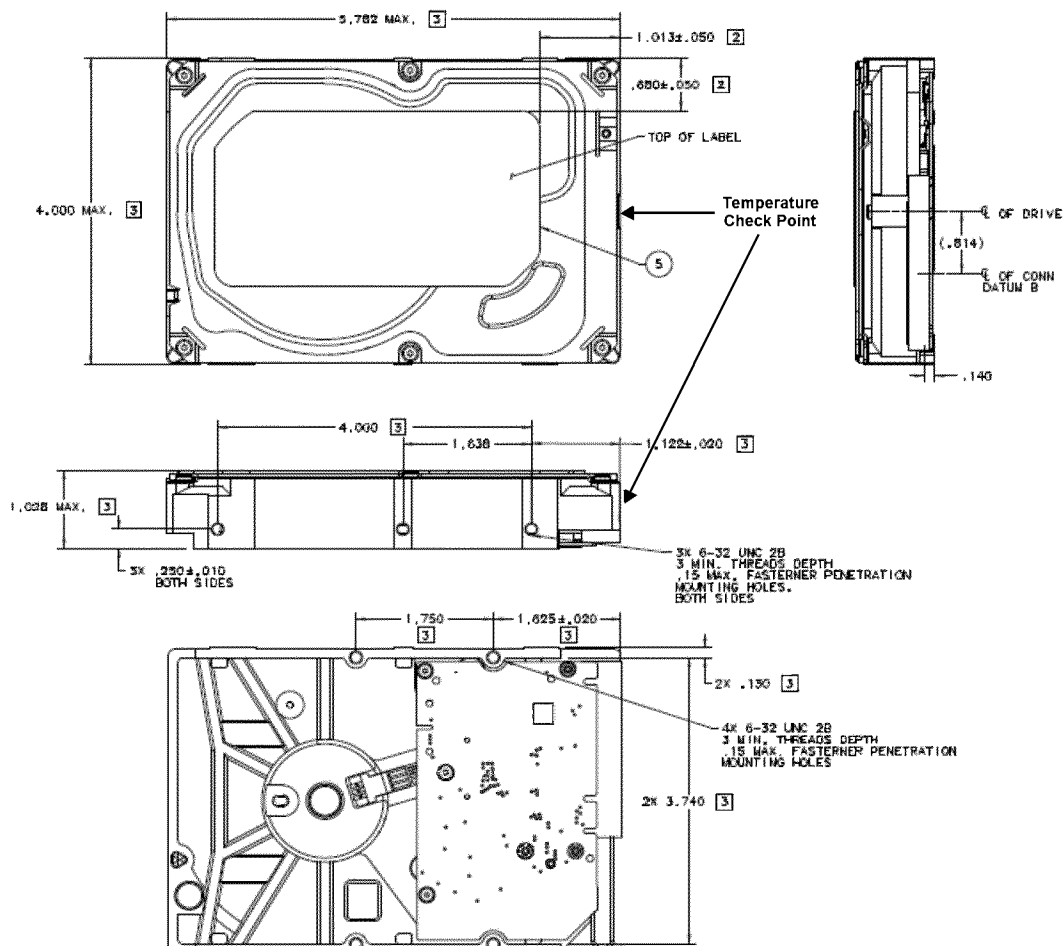
Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

Use only 6-32 UNC mounting screws.

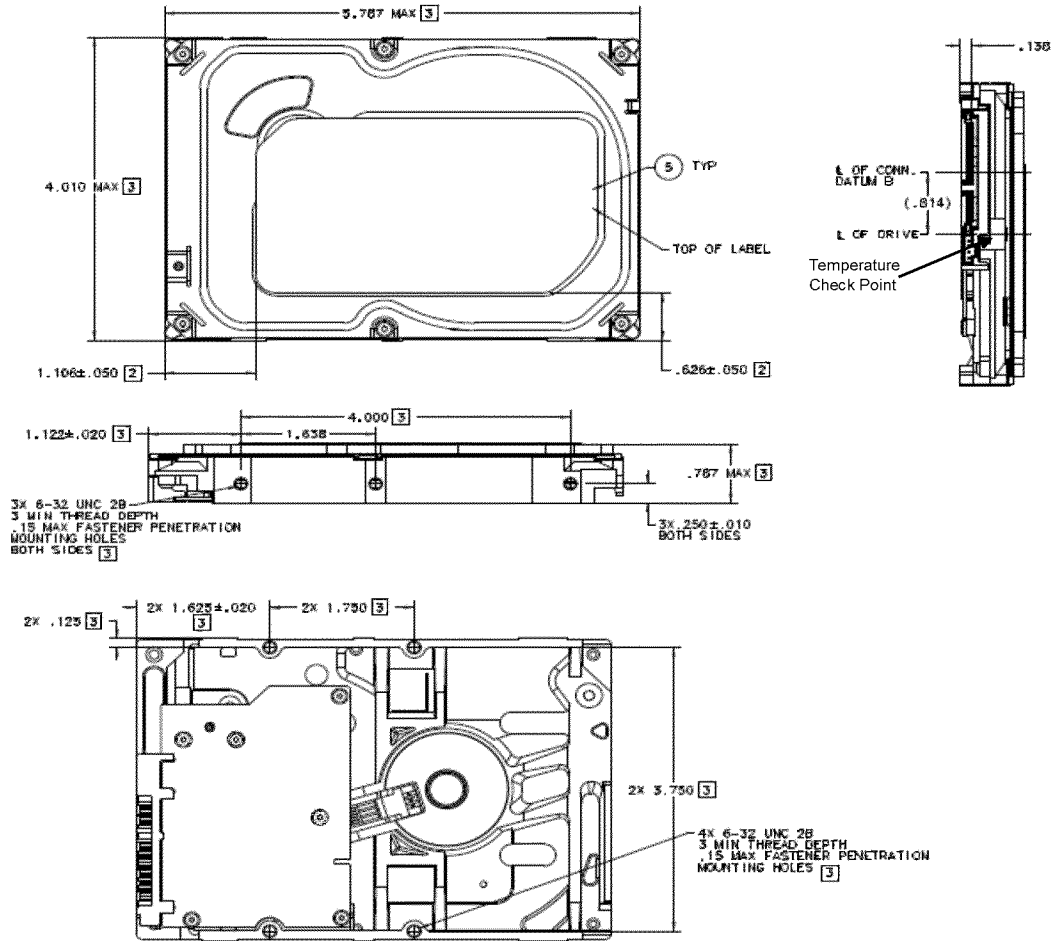
The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.

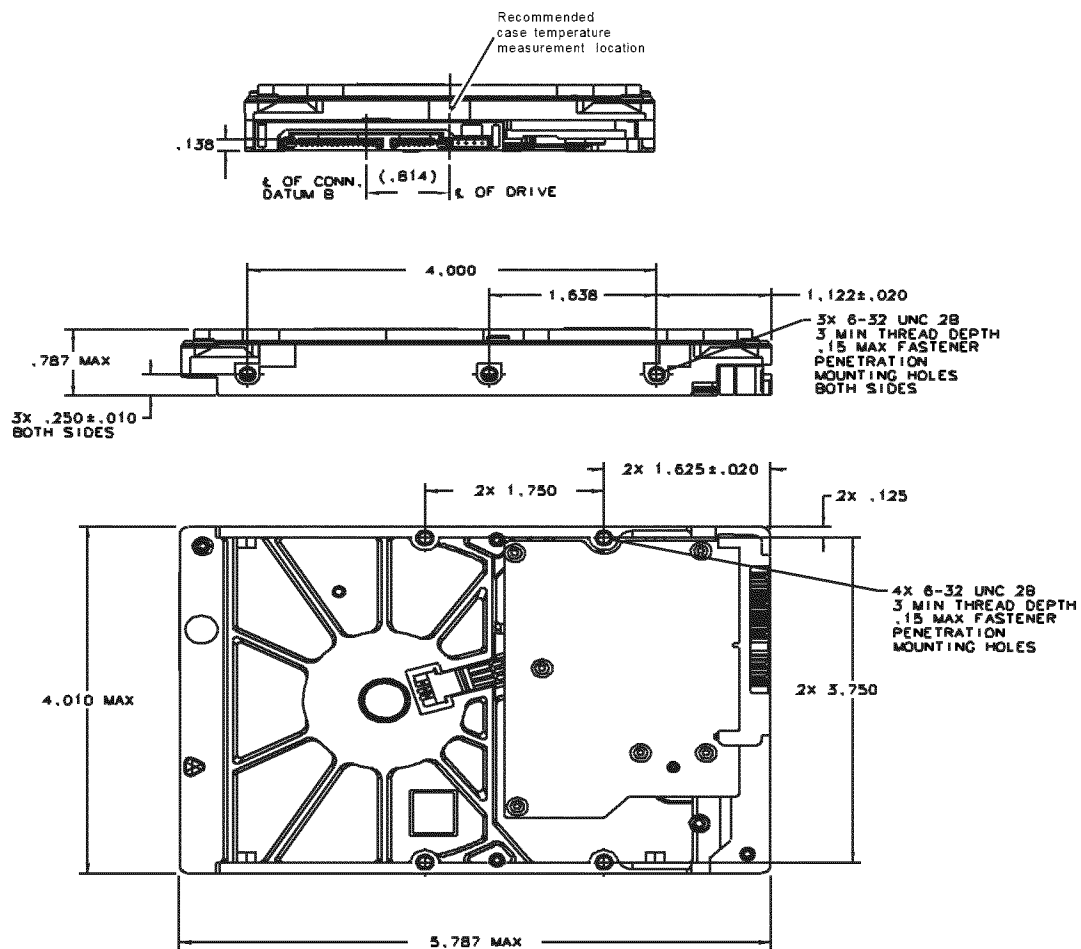
Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2 Mounting dimensions (3-disk: 3TB, 2TB; 2-disk: 1.5TB models)**





**Figure 3 Mounting dimensions (1-disk: 1TB and 750GB models)**

**Figure 4 Mounting dimensions (1-disk: 500GB, 320GB and 250GB models)**

## 4.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6. For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 4.1 Hot-Plug compatibility

Barracuda drives incorporate connectors which enable you to hot plug these drives in accordance with the SATA Revision 3.0 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 4.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATA connector pin definitions

Segment	Pin	Function	Definition
	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
<b>Signal</b>	S7	Ground	2nd mate
Key and spacing separate signal and power segments			

**Table 9 SATA connector pin definitions**

Segment	Pin	Function	Definition
<b>Power</b>	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

**Notes**

- All pins are in a single row, with a 1.27 mm (0.050") pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
  - All used voltage pins (V<sub>x</sub>) must be terminated.

**4.3 Supported ATA commands**

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See "S.M.A.R.T. commands" on page 37 for details and subcommands used in the S.M.A.R.T. implementation.

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>

Command name	Command code (in hex)
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address	F9 <sub>H</sub>

Command name	Command code (in hex)	
	Address: Password: Lock: Unlock: Freeze Lock:	00 <sub>H</sub> 01 <sub>H</sub> 02 <sub>H</sub> 03 <sub>H</sub> 04 <sub>H</sub>
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.		
Set Max Address Extended	37 <sub>H</sub>	
Set Multiple Mode	C6 <sub>H</sub>	
Sleep	E6 <sub>H</sub>	
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>	
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>	
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>	
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>	
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>	
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>	
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>	
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>	
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>	
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>	
Standby	E2 <sub>H</sub>	
Standby Immediate	E0 <sub>H</sub>	
Write Buffer	E8 <sub>H</sub>	
Write DMA	CA <sub>H</sub>	
Write DMA Extended	35 <sub>H</sub>	
Write DMA FUA Extended	3D <sub>H</sub>	
Write DMA Without Retries	CB <sub>H</sub>	
Write Log Extended	3F <sub>H</sub>	
Write Multiple	C5 <sub>H</sub>	
Write Multiple Extended	39 <sub>H</sub>	
Write Multiple FUA Extended	CE <sub>H</sub>	
Write Sectors	30 <sub>H</sub>	
Write Sectors Without Retries	31 <sub>H</sub>	
Write Sectors Extended	34 <sub>H</sub>	
Write Uncorrectable	45 <sub>H</sub>	

### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 30. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>



## SATA Interface

www.seagate.com

Word	Description	Value
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>

Word	Description	Value
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFF <sub>H</sub> .	ST3000DM001 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

<b>Note</b>	Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.
-------------	-----------------------------------------------------------------------------------------------------

<b>Note</b>	See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.
-------------	-------------------------------------------------------------------------------------

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.

	5	GPL feature set is supported.
	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
	00 <sub>H</sub> Set PIO mode to default (PIO mode 2).
	01 <sub>H</sub> Set PIO mode to default and disable IORDY (PIO mode 2).
	08 <sub>H</sub> PIO mode 0
	09 <sub>H</sub> PIO mode 1

	0A <sub>H</sub> PIO mode 2
	0B <sub>H</sub> PIO mode 3
	0C <sub>H</sub> PIO mode 4 ( <i>default</i> )
	20 <sub>H</sub> Multiword DMA mode 0
	21 <sub>H</sub> Multiword DMA mode 1
	22 <sub>H</sub> Multiword DMA mode 2
	40 <sub>H</sub> Ultra DMA mode 0
	41 <sub>H</sub> Ultra DMA mode 1
	42 <sub>H</sub> Ultra DMA mode 2
	43 <sub>H</sub> Ultra DMA mode 3
	44 <sub>H</sub> Ultra DMA mode 4
	45 <sub>H</sub> Ultra DMA mode 5
	46 <sub>H</sub> Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note**

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 4.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)

Code in features register	S.M.A.R.T. command
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

**Note**

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.

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## Exhibit 4



Product Manual

# Barracuda<sup>®</sup>

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

Gen 14  
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For Seagate reseller portal, visit <http://spp.seagate.com>



## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following Seagate Barracuda® model drives:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queueing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors.
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

### 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow you to install a SATA host adapter and SATA disk drive in your current system and expect all of your existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

**Introduction**[www.seagate.com](http://www.seagate.com)

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

**Note**

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001 ST2000DM001	ST1500DM003	ST1000DM003 ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168 3,907,029,168	2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1807kFCI	1807kFCI	1807kFCI
Track density (avg)	352ktracks/in	352ktracks/in	352ktracks/in
Areal density (avg)	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	2147Mb/s	2147Mb/s	2147 Mb/s
Average data rate, read/write (MB/s)	156MB/s	156MB/s	156MB/s
Maximum sustained data rate, OD read (MB/s)	210MB/s	210MB/s	210MB/s
I/O data-transfer rate (max)	600MB/s	600MB/s	600 MB/s
Cache buffer	64MB	64MB	64MB
Height (max)	26.1mm / 1.028 in	26.1mm / 1.028 in	20.17mm / 0.7825 in
Width (max)	101.6mm /4.0 in (± 0.010 in)	101.6mm /4.0 in (± 0.010 in)	101.6mm / 4.0 in ( ± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	626g /1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<17.0s	<17.0s	<10.0s
Standby to ready (max)	<17.0s	<17.0s	<10.0s

## Drive Specifications

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**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001 ST2000DM001	ST1500DM003	ST1000DM003 ST750DM003
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical	<8.5ms (read) <9.5ms (write)	<8.5ms (read) <9.5ms (write)
Startup current (typical) 12V	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: $\pm 5\%$ 12V: $+10\%$ / $-7.5\%$	5V: $\pm 5\%$ 12V: $+10\%$ / $-7.5\%$	5V: $\pm 5\%$ 12V: $+10\%$ / $-7.5\%$
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C max (operating) 40.0°C max (non-operating)
Altitude, operating	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-304.8m to 3,048m15 (-1000 ft to 10,000+ ft)	-60.96m to 3,048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-60.96m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max)	80 Gs at 2ms	80 Gs at 2ms	80 Gs at 2ms
Non-Operational Shock (max)	300 Gs at 2ms	300 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs
Drive acoustics, sound power			
Idle***	ST3000DM001 and ST2000DM001 2.4 bels (typical) 2.6 bels (max)	ST1500DM003 2.4 bels (typical) 2.6 bels (max)	ST1000DM003 and ST750DM003 2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)	2.6 bels (typical) 2.7 bels (max)	2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per $10^{14}$ bits read	1 per $10^{14}$ bits read	1 per $10^{14}$ bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000	300,000	300,000
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.



**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2	2	1
Disks	1	1	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1413kb/in	1413kb/in	1413kb/in
Track density (avg)	236ktracks/in	236ktracks/in	236ktracks/in
Areal density (avg)	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	1695Mb/s	1695Mb/s	1695Mb/s
Average Data Rate, read/write (MB/s)	125MB/s	125MB/s	125MB/s
Maximum sustained data transfer rate, OD read (MB/s)	144MB/s	144MB/s	144MB/s
I/O data-transfer rate (max.)	600MB/s	600MB/s	600MB/s
Cache buffer	16MB	16MB	16MB
Height (max)	19.98mm / 0.787 in	19.98mm / 0.787 in	19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	415g / 0.915 lb	415g / 0.915 lb	415g / 0.915 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<8.5s	<8.5s	<8.5s
Standby to ready (max)	<8.5s	<8.5s	<8.5s
Average seek, read (typical)	<8.5ms (read)	<8.5ms (read)	<8.5ms (read)
Average seek, write (typical)	<9.5ms (write)	<9.5ms (write)	<9.5ms (write)
Startup current (typical) 12V	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)
Altitude, operating	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-304.8m to 3,048m (-1000 ft to 10,000+ ft)	-304.8m to 3,048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max)	70 Gs at 2ms	70 Gs at 2ms	70 Gs at 2ms

## Drive Specifications

www.seagate.com

**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Non-Operational Shock (max)	350 Gs at 2ms	350 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)
Seek	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> . From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001	3000GB	5,860,533,168	4k
ST2000DM001	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

## 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 $\pm$ 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600

## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB and 750GB	20.17mm / 0.7825 in
500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in ( ± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

**Note**

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	<b>3-disk</b> (3TB, 2TB models)	<b>2-disk</b> (1.5TB model)	<b>1-disk</b> (1TB, 750GB models)	<b>1-disk</b> (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Standby to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1** on page 26.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3**, **Table 4**, **Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

<b>Power dissipation (3-disk values shown)</b>	<b>Avg (watts 25° C)</b>	<b>Avg 5V typ amps</b>	<b>Avg 12V typ amps</b>
Spinup	—	—	2.0
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4 DC power requirements (2-disk: 1.5TB model)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.006
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

### Note

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

### 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V

±5%

12V

+10% / -7.5%

### 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

#### Active mode

The drive is in Active mode during the read/write and seek operations.

#### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

#### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

### 2.9.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 69°C (156°F) within the operating ambient conditions. Refer to **Section 3.4 on page 26** for base plate measurement location.

<b>Operating</b>	0° to 60°C (32° to 140°F)
<b>Non-operating</b>	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

<b>Operating</b>	20°C per hour (68°F per hour max), without condensation
<b>Non-operating</b>	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

<b>Operating</b>	5% to 95% non-condensing (30% per hour max)
<b>Nonoperating</b>	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

<b>Operating</b>	37.7°C (99.9°F max)
<b>Non-operating</b>	40°C (104°F max)

### 2.9.4 Altitude

<b>Operating</b>	–304.8m to 3,048m (–1000 ft. to 10,000+ ft.)
<b>Non-operating</b>	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

### 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

#### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

#### 2.9.5.2 Non-operating shock

##### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.



**1TB, 750GB, 500GB, 320GB and 250GB models**

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

**2.9.5.3 Operating vibration**

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

**2.9.6 Non-operating vibration**

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

**2.10 Acoustics**

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note**

For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

(Number of seeks per second =  $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (1.5TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in Table 8.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:  
[support.seagate.com/customer/warranty\\_validation.jsp](http://support.seagate.com/customer/warranty_validation.jsp)

From this page, click on the “Verify Your Warranty” link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.

## 2.13 Agency certification

### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

**Korean RRL**

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

**Australian C-Tick (N176)**

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

**2.13.3FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

**2.14 Environmental protection**

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

**2.14.1European Union Restriction of Hazardous Substances (RoHS) Directive**

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

**2.14.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令**

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

**2.15 Corrosive environment**

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

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This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until you mount it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if you connect the drive and receive a “drive not detected” error, your SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

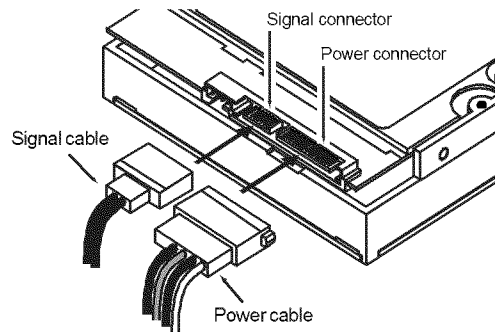
### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See [Table 9](#) for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, you can connect the drive as illustrated in [Figure 1](#).

**Figure 1 Attaching SATA cabling**



Each cable is keyed to ensure correct orientation. Barracuda drives support latching SATA connectors.

### 3.4 Drive mounting

You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2**, **Figure 3**, and **Figure 4** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

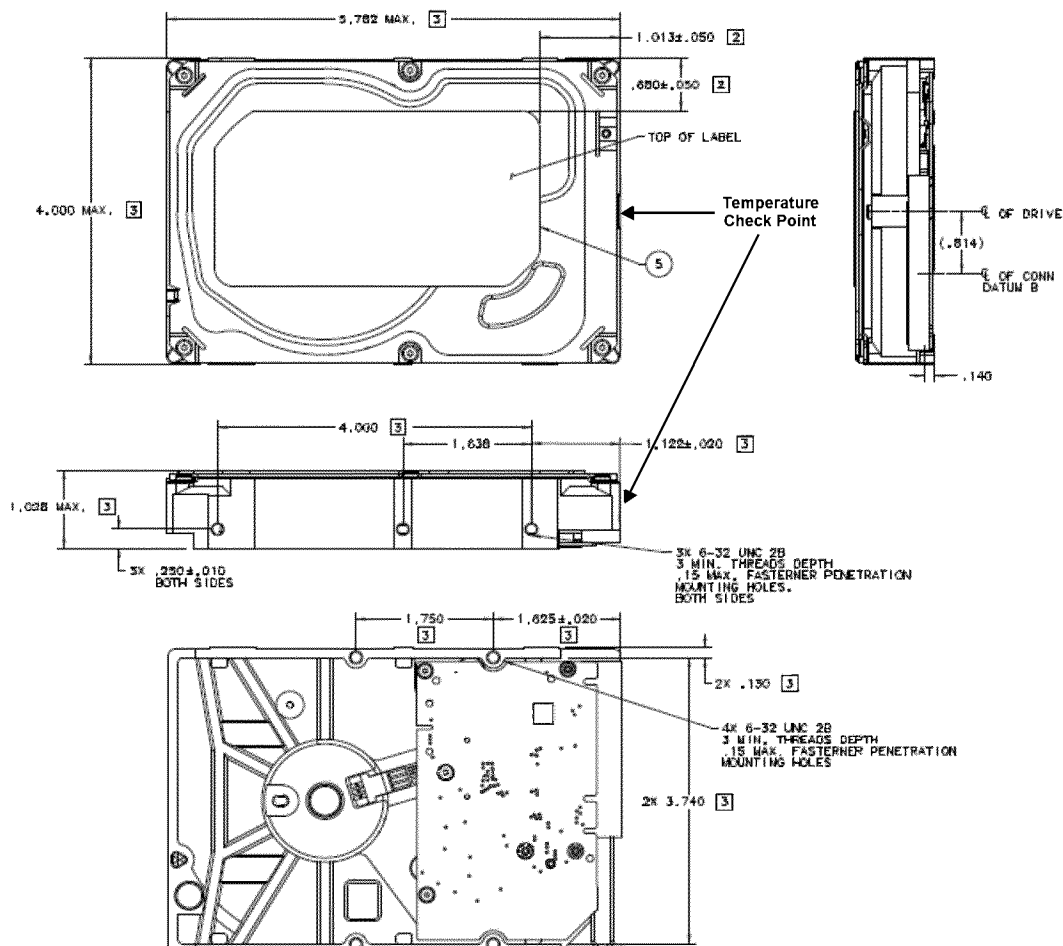
Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

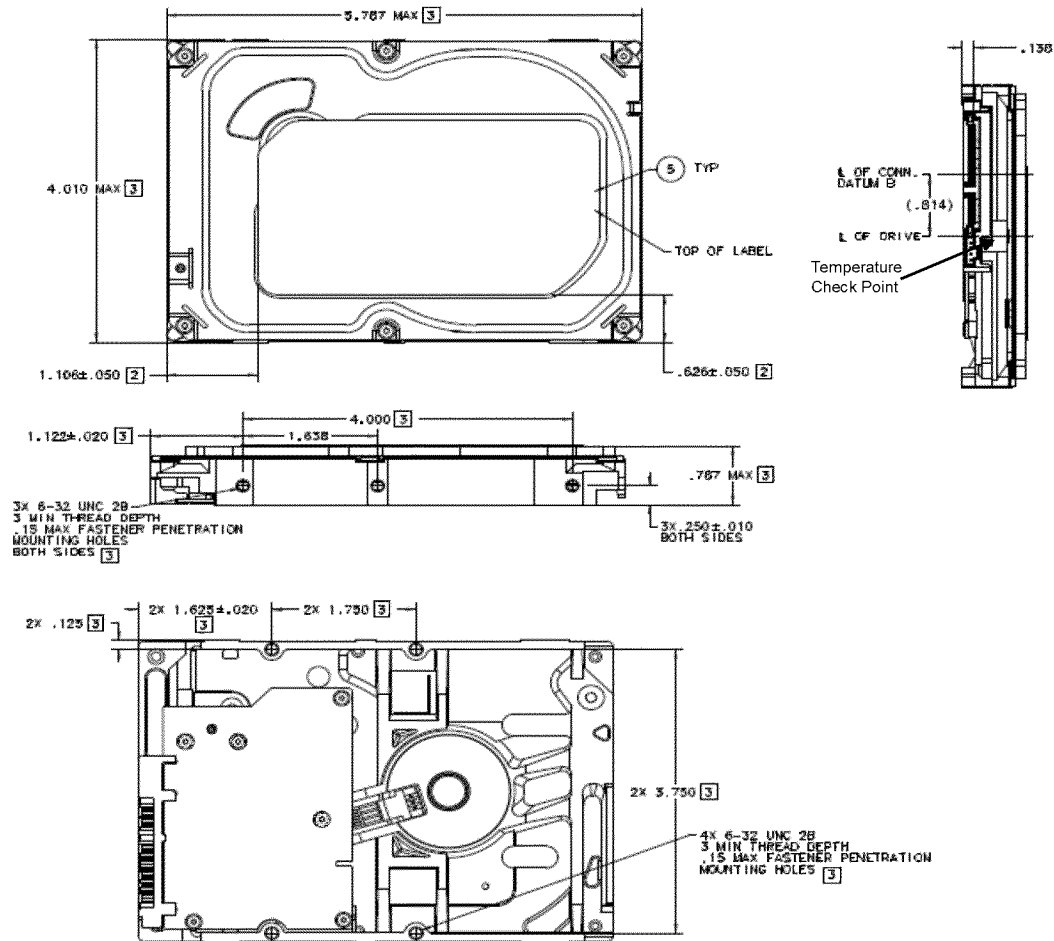
Use only 6-32 UNC mounting screws.

The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.

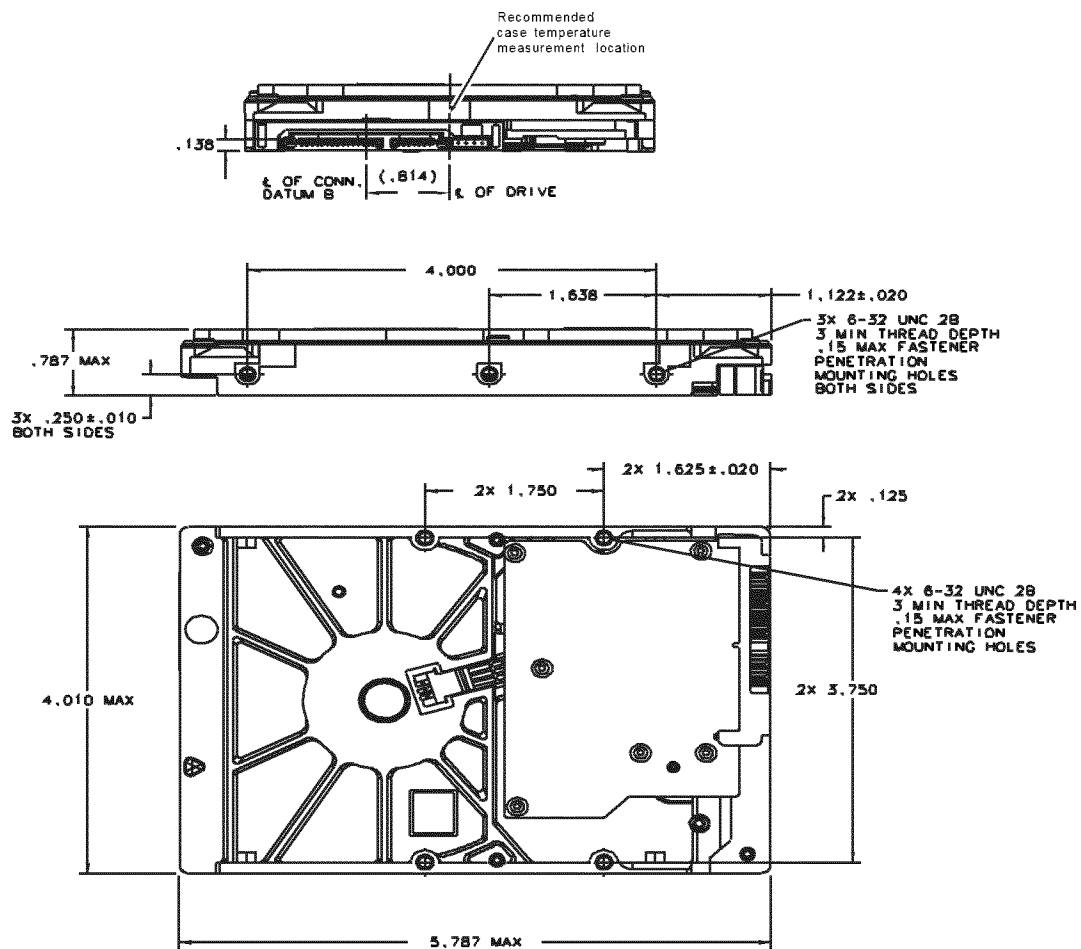
Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2 Mounting dimensions (3-disk: 3TB, 2TB; 2-disk: 1.5TB models)**



**Figure 3 Mounting dimensions (1-disk: 1TB and 750GB models)**



**Figure 4 Mounting dimensions (1-disk: 500GB, 320GB and 250GB models)**



## 4.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6. For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 4.1 Hot-Plug compatibility

Barracuda drives incorporate connectors which enable you to hot plug these drives in accordance with the SATA Revision 3.0 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 4.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATA connector pin definitions

Segment	Pin	Function	Definition
	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
<b>Signal</b>	S7	Ground	2nd mate
Key and spacing separate signal and power segments			

**Table 9 SATA connector pin definitions**

Segment	Pin	Function	Definition
<b>Power</b>	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

**Notes**

- All pins are in a single row, with a 1.27 mm (0.050") pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
  - All used voltage pins (V<sub>x</sub>) must be terminated.

**4.3 Supported ATA commands**

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See "S.M.A.R.T. commands" on page 37 for details and subcommands used in the S.M.A.R.T. implementation.

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>

Command name	Command code (in hex)
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address	F9 <sub>H</sub>

Command name	Command code (in hex)	
	Address:	00 <sub>H</sub>
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Password:	01 <sub>H</sub>
	Lock:	02 <sub>H</sub>
	Unlock:	03 <sub>H</sub>
	Freeze Lock:	04 <sub>H</sub>
Set Max Address Extended	37 <sub>H</sub>	
Set Multiple Mode	C6 <sub>H</sub>	
Sleep	E6 <sub>H</sub>	
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>	
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>	
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>	
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>	
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>	
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>	
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>	
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>	
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>	
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>	
Standby	E2 <sub>H</sub>	
Standby Immediate	E0 <sub>H</sub>	
Write Buffer	E8 <sub>H</sub>	
Write DMA	CA <sub>H</sub>	
Write DMA Extended	35 <sub>H</sub>	
Write DMA FUA Extended	3D <sub>H</sub>	
Write DMA Without Retries	CB <sub>H</sub>	
Write Log Extended	3F <sub>H</sub>	
Write Multiple	C5 <sub>H</sub>	
Write Multiple Extended	39 <sub>H</sub>	
Write Multiple FUA Extended	CE <sub>H</sub>	
Write Sectors	30 <sub>H</sub>	
Write Sectors Without Retries	31 <sub>H</sub>	
Write Sectors Extended	34 <sub>H</sub>	
Write Uncorrectable	45 <sub>H</sub>	

### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 30. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>

## SATA Interface

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Word	Description	Value
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>

Word	Description	Value
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFF <sub>H</sub> .	ST3000DM001 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

<b>Note</b>	Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.
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<b>Note</b>	See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.
-------------	-------------------------------------------------------------------------------------

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.

	5	GPL feature set is supported.
	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
	00 <sub>H</sub> Set PIO mode to default (PIO mode 2).
	01 <sub>H</sub> Set PIO mode to default and disable IORDY (PIO mode 2).
	08 <sub>H</sub> PIO mode 0
	09 <sub>H</sub> PIO mode 1



	0A <sub>H</sub> PIO mode 2
	0B <sub>H</sub> PIO mode 3
	0C <sub>H</sub> PIO mode 4 ( <i>default</i> )
	20 <sub>H</sub> Multiword DMA mode 0
	21 <sub>H</sub> Multiword DMA mode 1
	22 <sub>H</sub> Multiword DMA mode 2
	40 <sub>H</sub> Ultra DMA mode 0
	41 <sub>H</sub> Ultra DMA mode 1
	42 <sub>H</sub> Ultra DMA mode 2
	43 <sub>H</sub> Ultra DMA mode 3
	44 <sub>H</sub> Ultra DMA mode 4
	45 <sub>H</sub> Ultra DMA mode 5
	46 <sub>H</sub> Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note**

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 4.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)

Code in features register	S.M.A.R.T. command
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

**Note**

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## Exhibit 5



Product Manual

# Barracuda<sup>®</sup>

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

Gen 14  
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January 2012

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Revision	Date	Description of Change
Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
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Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).

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One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Seagate reserves the right to change, without notice, product offerings or specifications.

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# Seagate Technology Support Services

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For information regarding data recovery services, visit <http://www.i365.com>

For Seagate OEM and Distribution partner portal, visit <https://direct.seagate.com/portal/system>

For Seagate reseller portal, visit <http://spp.seagate.com>





## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following Seagate Barracuda® model drives:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queueing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors.
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

### 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow you to install a SATA host adapter and SATA disk drive in your current system and expect all of your existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

**Introduction**[www.seagate.com](http://www.seagate.com)

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

**Note**

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

ST3000DM001      ST2000DM001      ST1500DM003      ST1000DM003  
ST750DM003      ST500DM002      ST320DM000      ST250DM000

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001 ST2000DM001	ST1500DM003	ST1000DM003 ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168 3,907,029,168	2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1807kFCI	1807kFCI	1807kFCI
Track density (avg)	352ktracks/in	352ktracks/in	352ktracks/in
Areal density (avg)	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	2147Mb/s	2147Mb/s	2147Mb/s
Average data rate, read/write (MB/s)	156MB/s	156MB/s	156MB/s
Maximum sustained data rate, OD read (MB/s)	210MB/s	210MB/s	210MB/s
I/O data-transfer rate (max)	600MB/s	600MB/s	600MB/s
Cache buffer	64MB	64MB	64MB
Height (max)	26.1mm / 1.028 in	26.1mm / 1.028 in	20.17mm / 0.7825 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<17.0s	<17.0s	<10.0s
Standby to ready (max)	<17.0s	<17.0s	<10.0s

## Drive Specifications

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**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001 ST2000DM001	ST1500DM003	ST1000DM003 ST750DM003
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical	<8.5ms (read) <9.5ms (write)	<8.5ms (read) <9.5ms (write)
Startup current (typical) 12V	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C max (operating) 40.0°C max (non-operating)
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max)	80 Gs at 2ms	80 Gs at 2ms	80 Gs at 2ms
Non-Operational Shock (max)	300 Gs at 2ms	300 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs
Drive acoustics, sound power			
Idle***	ST3000DM001 and ST2000DM001 2.4 bels (typical) 2.6 bels (max)	ST1500DM003 2.4 bels (typical) 2.6 bels (max)	ST1000DM003 and ST750DM003 2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)	2.6 bels (typical) 2.7 bels (max)	2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000	300,000	300,000
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2	2	1
Disks	1	1	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1413kb/in	1413kb/in	1413kb/in
Track density (avg)	236ktracks/in	236ktracks/in	236ktracks/in
Areal density (avg)	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	1695Mb/s	1695Mb/s	1695Mb/s
Average Data Rate, read/write (MB/s)	125MB/s	125MB/s	125MB/s
Maximum sustained data transfer rate, OD read (MB/s)	144MB/s	144MB/s	144MB/s
I/O data-transfer rate (max.)	600MB/s	600MB/s	600MB/s
Cache buffer	16MB	16MB	16MB
Height (max)	19.98mm / 0.787 in	19.98mm / 0.787 in	19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	415g / 0.915 lb	415g / 0.915 lb	415g / 0.915 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<8.5s	<8.5s	<8.5s
Standby to ready (max)	<8.5s	<8.5s	<8.5s
Average seek, read (typical)	<8.5ms (read)	<8.5ms (read)	<8.5ms (read)
Average seek, write (typical)	<9.5ms (write)	<9.5ms (write)	<9.5ms (write)
Startup current (typical) 12V	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max)	70 Gs at 2ms	70 Gs at 2ms	70 Gs at 2ms

## Drive Specifications

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**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Non-Operational Shock (max)	350 Gs at 2ms	350 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)
Seek	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> . From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001	3000GB	5,860,533,168	4k
ST2000DM001	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

## 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600



## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB and 750GB	20.17mm / 0.7825 in
500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in ( ± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

### Note

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	<b>3-disk</b> (3TB, 2TB models)	<b>2-disk</b> (1.5TB model)	<b>1-disk</b> (1TB, 750GB models)	<b>1-disk</b> (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Standby to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1** on page 26.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3**, **Table 4**, **Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

<b>Power dissipation (3-disk values shown)</b>	<b>Avg (watts 25° C)</b>	<b>Avg 5V typ amps</b>	<b>Avg 12V typ amps</b>
Spinup	—	—	2.0
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4 DC power requirements (2-disk: 1.5TB model)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

### Note

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

### 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V

±5%

12V

+10% / -7.5%

### 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

#### Active mode

The drive is in Active mode during the read/write and seek operations.

#### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

#### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

### 2.9.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 69°C (156°F) within the operating ambient conditions. Refer to **Section 3.4 on page 26** for base plate measurement location.

<b>Operating</b>	0° to 60°C (32° to 140°F)
<b>Non-operating</b>	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

<b>Operating</b>	20°C per hour (68°F per hour max), without condensation
<b>Non-operating</b>	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

<b>Operating</b>	5% to 95% non-condensing (30% per hour max)
<b>Nonoperating</b>	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

<b>Operating</b>	37.7°C (99.9°F max)
<b>Non-operating</b>	40°C (104°F max)

### 2.9.4 Altitude

<b>Operating</b>	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
<b>Non-operating</b>	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

### 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

#### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

#### 2.9.5.2 Non-operating shock

##### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

**1TB, 750GB, 500GB, 320GB and 250GB models**

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

**2.9.5.3 Operating vibration**

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

**2.9.6 Non-operating vibration**

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

**2.10 Acoustics**

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note**

For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

(Number of seeks per second =  $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (1.5TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in Table 8.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:  
[support.seagate.com/customer/warranty\\_validation.jsp](http://support.seagate.com/customer/warranty_validation.jsp)

From this page, click on the “Verify Your Warranty” link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.

## 2.13 Agency certification

### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

**Korean RRL**

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

**Australian C-Tick (N176)**

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

**2.13.3FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

**2.14 Environmental protection**

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

**2.14.1European Union Restriction of Hazardous Substances (RoHS) Directive**

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.



**2.14.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令**

This product has an Environmental Protection Use Period (EUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

**2.15 Corrosive environment**

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

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This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until you mount it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

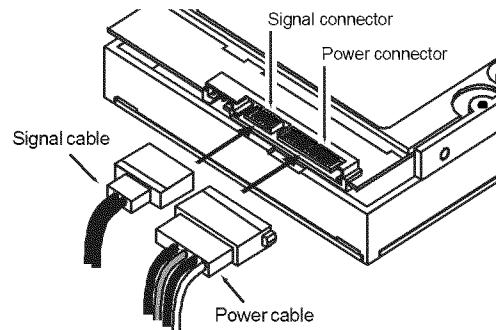
SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if you connect the drive and receive a “drive not detected” error, your SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See [Table 9](#) for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, you can connect the drive as illustrated in [Figure 1](#).

**Figure 1 Attaching SATA cabling**

Each cable is keyed to ensure correct orientation. Barracuda drives support latching SATA connectors.

### 3.4 Drive mounting

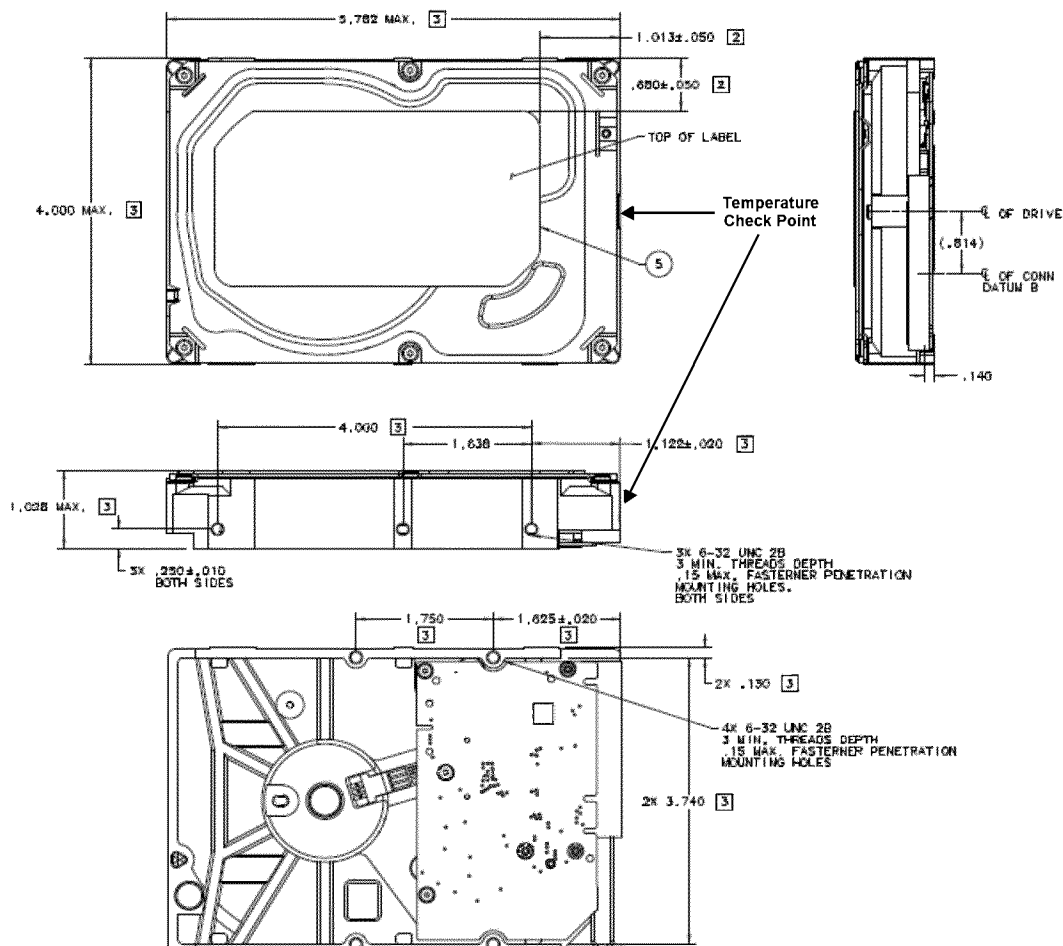
You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2**, **Figure 3**, and **Figure 4** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

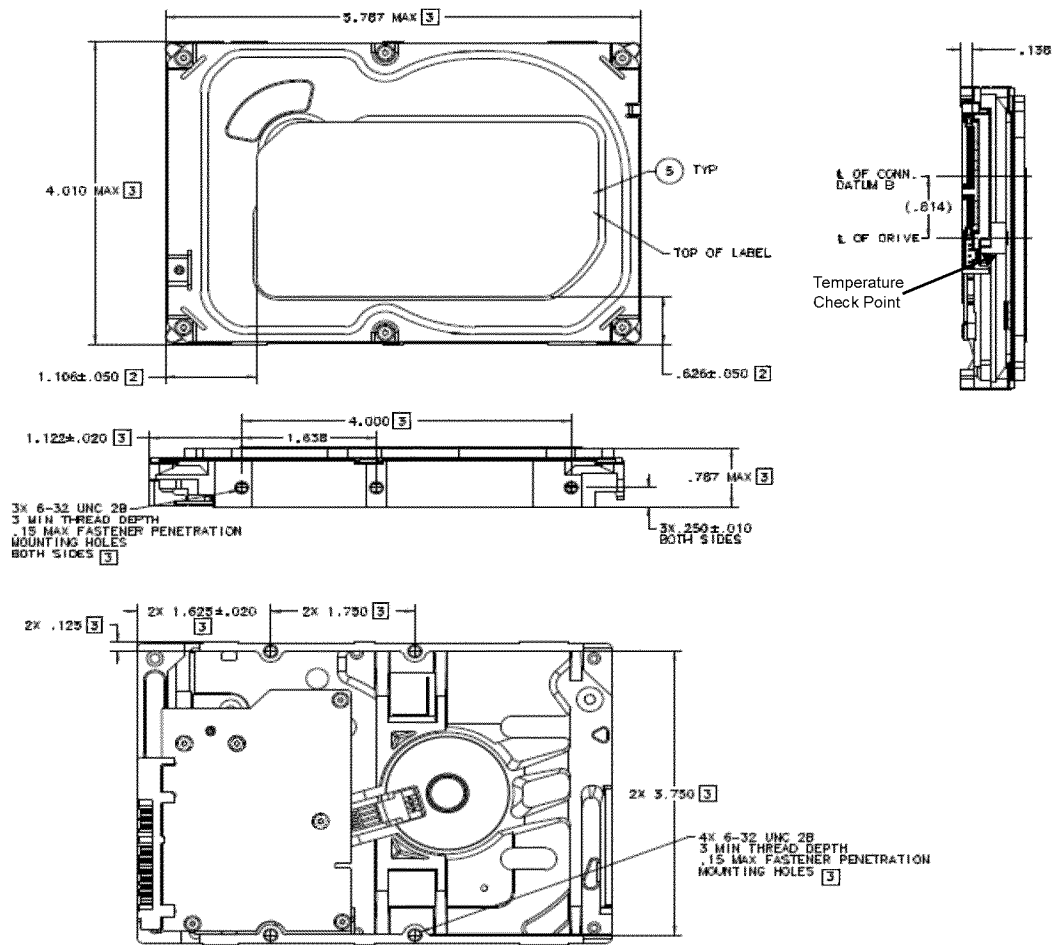
Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

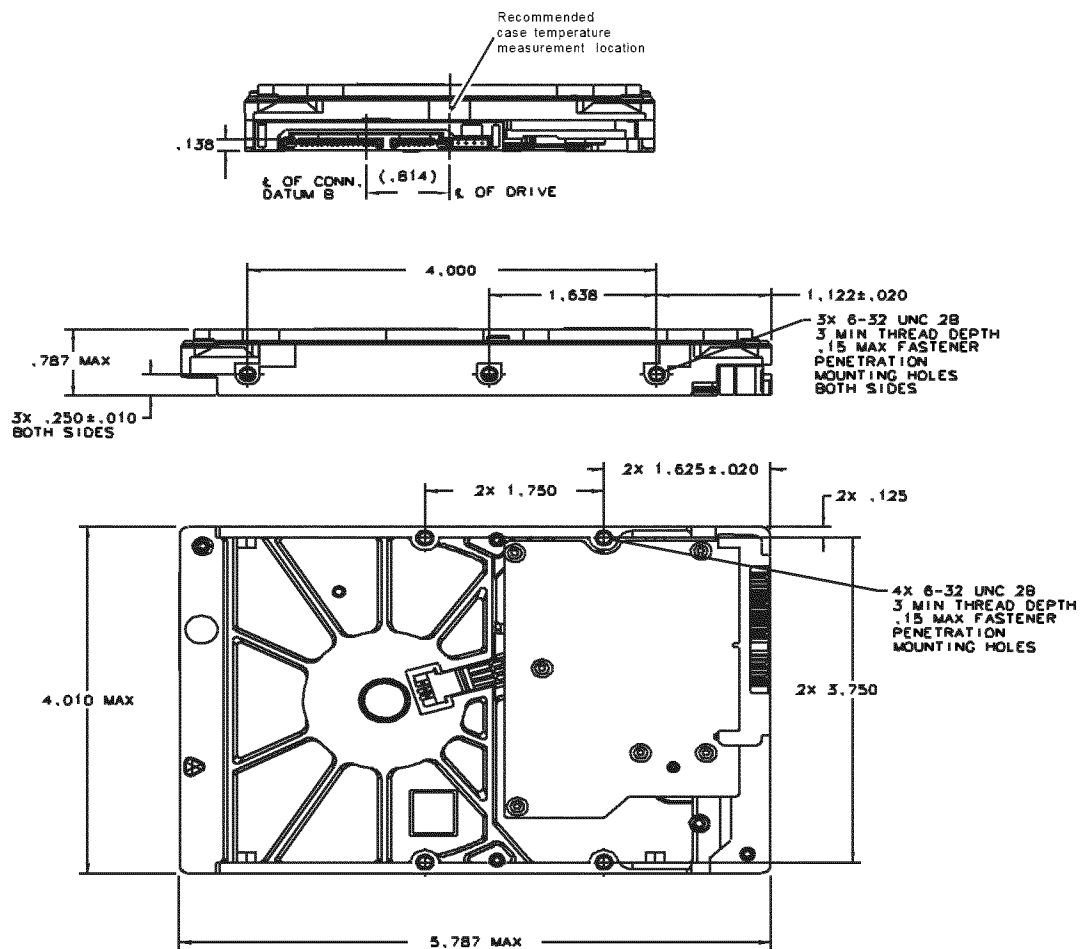
Use only 6-32 UNC mounting screws.

The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.

Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2 Mounting dimensions (3-disk: 3TB, 2TB; 2-disk: 1.5TB models)**

**Figure 3 Mounting dimensions (1-disk: 1TB and 750GB models)**

**Figure 4 Mounting dimensions (1-disk: 500GB, 320GB and 250GB models)**

## 4.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 4.1 Hot-Plug compatibility

Barracuda drives incorporate connectors which enable you to hot plug these drives in accordance with the SATA Revision 3.0 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 4.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATA connector pin definitions

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			

**Table 9 SATA connector pin definitions (continued)**

Segment	Pin	Function	Definition
<b>Power</b>	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

**Notes**

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:  
the ground pins P4 and P12.  
the pre-charge power pins and the other ground pins.  
the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.  
All used voltage pins (V<sub>x</sub>) must be terminated.

**4.3 Supported ATA commands**

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 38 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 10 SATA standard commands**

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>

**Table 10 SATA standard commands (continued)**

Command name	Command code (in hex)
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address	F9 <sub>H</sub>



**Table 10 SATA standard commands (continued)**

Command name	Command code (in hex)										
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	<table> <tr> <td>Address:</td><td>00<sub>H</sub></td></tr> <tr> <td>Password:</td><td>01<sub>H</sub></td></tr> <tr> <td>Lock:</td><td>02<sub>H</sub></td></tr> <tr> <td>Unlock:</td><td>03<sub>H</sub></td></tr> <tr> <td>Freeze Lock:</td><td>04<sub>H</sub></td></tr> </table>	Address:	00 <sub>H</sub>	Password:	01 <sub>H</sub>	Lock:	02 <sub>H</sub>	Unlock:	03 <sub>H</sub>	Freeze Lock:	04 <sub>H</sub>
Address:	00 <sub>H</sub>										
Password:	01 <sub>H</sub>										
Lock:	02 <sub>H</sub>										
Unlock:	03 <sub>H</sub>										
Freeze Lock:	04 <sub>H</sub>										
Set Max Address Extended	37 <sub>H</sub>										
Set Multiple Mode	C6 <sub>H</sub>										
Sleep	E6 <sub>H</sub>										
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>										
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>										
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>										
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>										
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>										
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>										
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>										
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>										
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>										
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>										
Standby	E2 <sub>H</sub>										
Standby Immediate	E0 <sub>H</sub>										
Write Buffer	E8 <sub>H</sub>										
Write DMA	CA <sub>H</sub>										
Write DMA Extended	35 <sub>H</sub>										
Write DMA FUA Extended	3D <sub>H</sub>										
Write DMA Without Retries	CB <sub>H</sub>										
Write Log Extended	3F <sub>H</sub>										
Write Multiple	C5 <sub>H</sub>										
Write Multiple Extended	39 <sub>H</sub>										
Write Multiple FUA Extended	CE <sub>H</sub>										
Write Sectors	30 <sub>H</sub>										
Write Sectors Without Retries	31 <sub>H</sub>										
Write Sectors Extended	34 <sub>H</sub>										
Write Uncorrectable	45 <sub>H</sub>										

### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 30. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>

**Table 11 Identify Device commands (continued)**

Word	Description	Value
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100-103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>

**Table 11 Identify Device commands (continued)**

Word	Description	Value
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFh.	ST3000DM001 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

**Note**

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

**Note**

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.

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	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.
	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note**

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 4.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 13 S.M.A.R.T. commands**

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

**Note**

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.

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January 2012*

## Exhibit 6



Product Manual

# Barracuda<sup>®</sup>

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

Gen 14  
100686584  
Rev. E  
June 2012

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Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
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One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Seagate reserves the right to change, without notice, product offerings or specifications.



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# Seagate Technology Support Services

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For information regarding data recovery services, visit <http://www.i365.com>

For Seagate OEM and Distribution partner portal, visit <https://direct.seagate.com/portal/system>

For Seagate reseller portal, visit <http://spp.seagate.com>



## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following Seagate Barracuda® model drives:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

These drives provide the following key features:

- 7200 RPM spindle speed.

- High instantaneous (burst) data-transfer rates (up to 600MB per second).

- TGMR recording technology provides the drives with increased areal density.

- State-of-the-art cache and on-the-fly error-correction algorithms.

- Native Command Queueing with command ordering to increase performance in demanding applications.

- Full-track multiple-sector transfer capability without local processor intervention.

- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.

- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.

- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors

- Quiet operation.

- Compliant with RoHS requirements in China and Europe.

- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.

- Support for S.M.A.R.T. drive monitoring and reporting.

- Supports latching SATA cables and connectors.

- Worldwide Name (WWN) capability uniquely identifies the drive.

### 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.

- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.

- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow you to install a SATA host adapter and SATA disk drive in your current system and expect all of your existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

**Introduction**[www.seagate.com](http://www.seagate.com)

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

**Note**

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.



## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

ST3000DM001      ST2000DM001      ST1500DM003      ST1000DM003  
ST750DM003      ST500DM002      ST320DM000      ST250DM000

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001 ST2000DM001	ST1500DM003	ST1000DM003 ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168 3,907,029,168	2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1807kFCI	1807kFCI	1807kFCI
Track density (avg)	352ktracks/in	352ktracks/in	352ktracks/in
Areal density (avg)	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	2147Mb/s	2147Mb/s	2147Mb/s
Average data rate, read/write (MB/s)	156MB/s	156MB/s	156MB/s
Maximum sustained data rate, OD read (MB/s)	210MB/s	210MB/s	210MB/s
I/O data-transfer rate (max)	600MB/s	600MB/s	600MB/s
Cache buffer	64MB	64MB	64MB
Height (max)	26.1mm / 1.028 in	26.1mm / 1.028 in	20.17mm / 0.7825 in
Width (max)	101.6mm /4.0 in (± 0.010 in)	101.6mm /4.0 in (± 0.010 in)	101.6mm / 4.0 in ( ± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	626g /1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<17.0s	<17.0s	<10.0s
Standby to ready (max)	<17.0s	<17.0s	<10.0s

## Drive Specifications

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**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001 ST2000DM001	ST1500DM003	ST1000DM003 ST750DM003
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical	<8.5ms (read) <9.5ms (write)	<8.5ms (read) <9.5ms (write)
Startup current (typical) 12V	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C max (operating) 40.0°C max (non-operating)
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max)	80 Gs at 2ms	80 Gs at 2ms	80 Gs at 2ms
Non-Operational Shock (max)	300 Gs at 2ms	300 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs
Drive acoustics, sound power	<b>ST3000DM001 and ST2000DM001</b>	<b>ST1500DM003</b>	<b>ST1000DM003 and ST750DM003</b>
Idle***	2.4 bels (typical) 2.6 bels (max)	2.4 bels (typical) 2.6 bels (max)	2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)	2.6 bels (typical) 2.7 bels (max)	2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000	300,000	300,000
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2	2	1
Disks	1	1	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1413kb/in	1413kb/in	1413kb/in
Track density (avg)	236ktracks/in	236ktracks/in	236ktracks/in
Areal density (avg)	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	1695Mb/s	1695Mb/s	1695Mb/s
Average Data Rate, read/write (MB/s)	125MB/s	125MB/s	125MB/s
Maximum sustained data transfer rate, OD read (MB/s)	144MB/s	144MB/s	144MB/s
I/O data-transfer rate (max.)	600MB/s	600MB/s	600MB/s
Cache buffer	16MB	16MB	16MB
Height (max)	19.98mm / 0.787 in	19.98mm / 0.787 in	19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	415g / 0.915 lb	415g / 0.915 lb	415g / 0.915 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<8.5s	<8.5s	<8.5s
Standby to ready (max)	<8.5s	<8.5s	<8.5s
Average seek, read (typical)	<8.5ms (read)	<8.5ms (read)	<8.5ms (read)
Average seek, write (typical)	<9.5ms (write)	<9.5ms (write)	<9.5ms (write)
Startup current (typical) 12V	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)
Operational Shock (max)	70 Gs at 2ms	70 Gs at 2ms	70 Gs at 2ms

## Drive Specifications

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**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Non-Operational Shock (max)	350 Gs at 2ms	350 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)
Seek	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> . From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001	3000GB	5,860,533,168	4k
ST2000DM001	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

## 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600

## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB and 750GB	20.17mm / 0.7825 in
500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in ( ± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

<b>Typical seek times (ms)</b>	<b>Read</b>	<b>Write</b>
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

### Note

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	<b>3-disk</b> (3TB, 2TB models)	<b>2-disk</b> (1.5TB model)	<b>1-disk</b> (1TB, 750GB models)	<b>1-disk</b> (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Standby to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1** on page 26.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3**, **Table 4**, **Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

<b>Power dissipation (3-disk values shown)</b>	<b>Avg (watts 25° C)</b>	<b>Avg 5V typ amps</b>	<b>Avg 12V typ amps</b>
Spinup	—	—	2.0
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4 DC power requirements (2-disk: 1.5TB model)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

### Note

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.



### 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V

±5%

12V

+10% / -7.5%

### 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

#### Active mode

The drive is in Active mode during the read/write and seek operations.

#### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

#### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

### 2.9.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 69°C (156°F) within the operating ambient conditions. Refer to **Section 3.4 on page 26** for base plate measurement location.

<b>Operating</b>	0° to 60°C (32° to 140°F)
<b>Non-operating</b>	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

<b>Operating</b>	20°C per hour (68°F per hour max), without condensation
<b>Non-operating</b>	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

<b>Operating</b>	5% to 95% non-condensing (30% per hour max)
<b>Nonoperating</b>	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

<b>Operating</b>	37.7°C (99.9°F max)
<b>Non-operating</b>	40°C (104°F max)

### 2.9.4 Altitude

<b>Operating</b>	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
<b>Non-operating</b>	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

### 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

#### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

#### 2.9.5.2 Non-operating shock

##### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

**1TB, 750GB, 500GB, 320GB and 250GB models**

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

**2.9.5.3 Operating vibration**

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

**2.9.6 Non-operating vibration**

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

**2.10 Acoustics**

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note**

For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

(Number of seeks per second =  $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (1.5TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in Table 8.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:  
[support.seagate.com/customer/warranty\\_validation.jsp](http://support.seagate.com/customer/warranty_validation.jsp)

From this page, click on the “Verify Your Warranty” link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.

## 2.13 Agency certification

### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

**Korean RRL**

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

**Australian C-Tick (N176)**

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

**2.13.3FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

**2.14 Environmental protection**

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

**2.14.1European Union Restriction of Hazardous Substances (RoHS) Directive**

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

**2.14.2 China Restriction of Hazardous Substances (RoHS) Directive** 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

**2.15 Corrosive environment**

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

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This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until you mount it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if you connect the drive and receive a “drive not detected” error, your SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

### 3.3 SATA cables and connectors

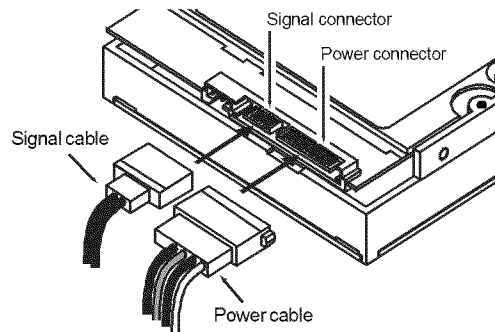
The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See [Table 9](#) for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, you can connect the drive as illustrated in [Figure 1](#).



**Figure 1 Attaching SATA cabling**



Each cable is keyed to ensure correct orientation. Barracuda drives support latching SATA connectors.

### 3.4 Drive mounting

You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2**, **Figure 3**, and **Figure 4** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

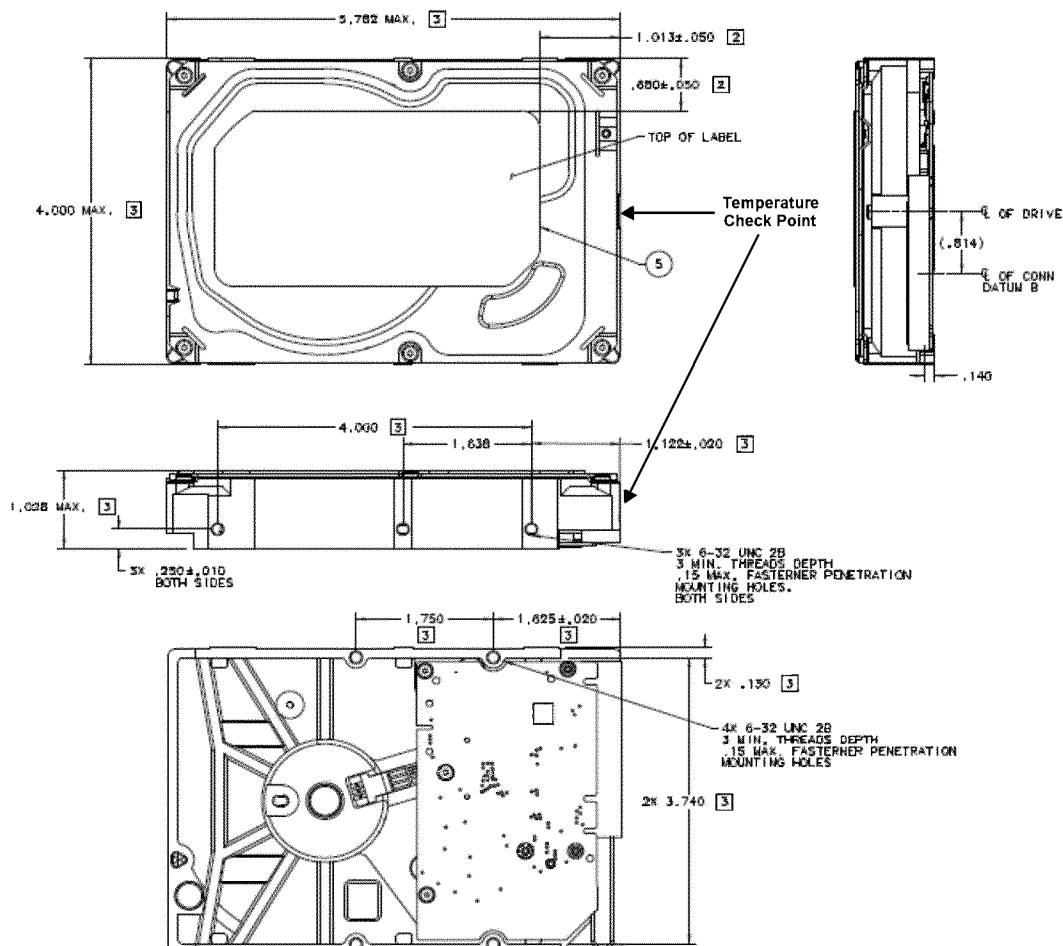
Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

Use only 6-32 UNC mounting screws.

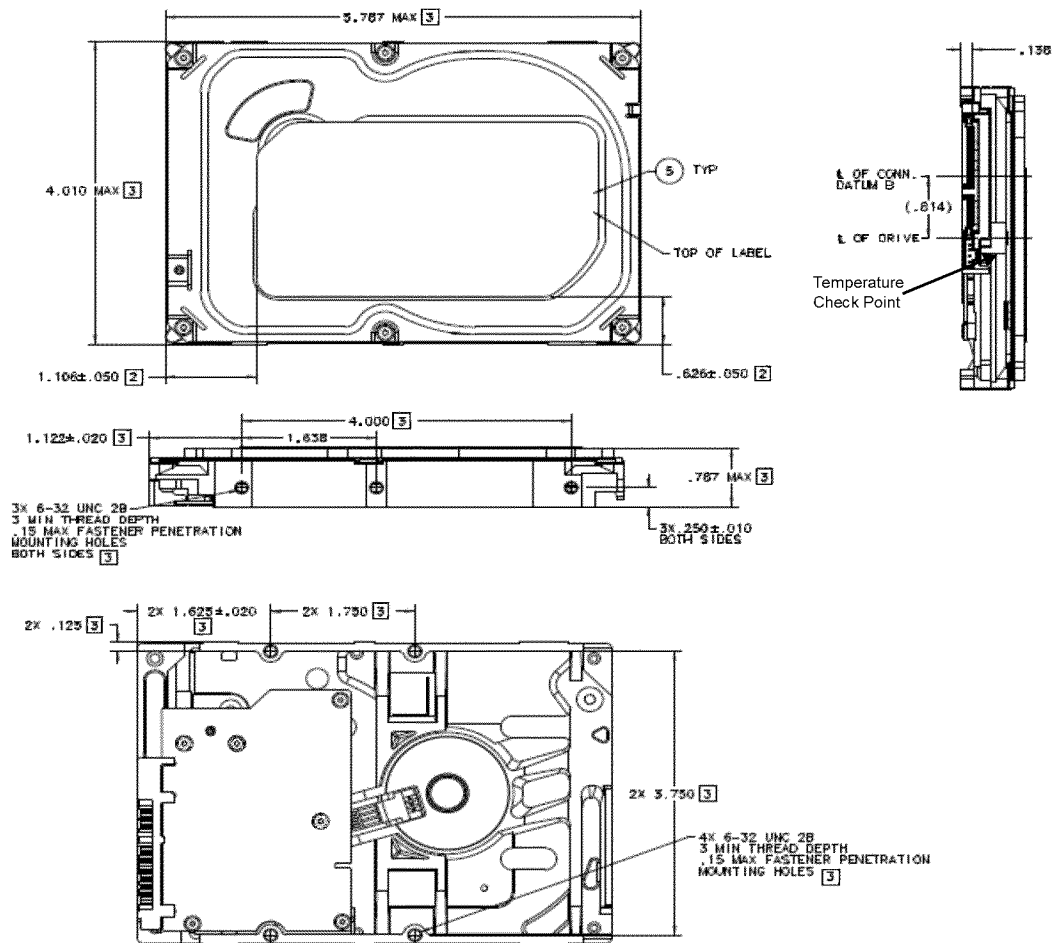
The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.

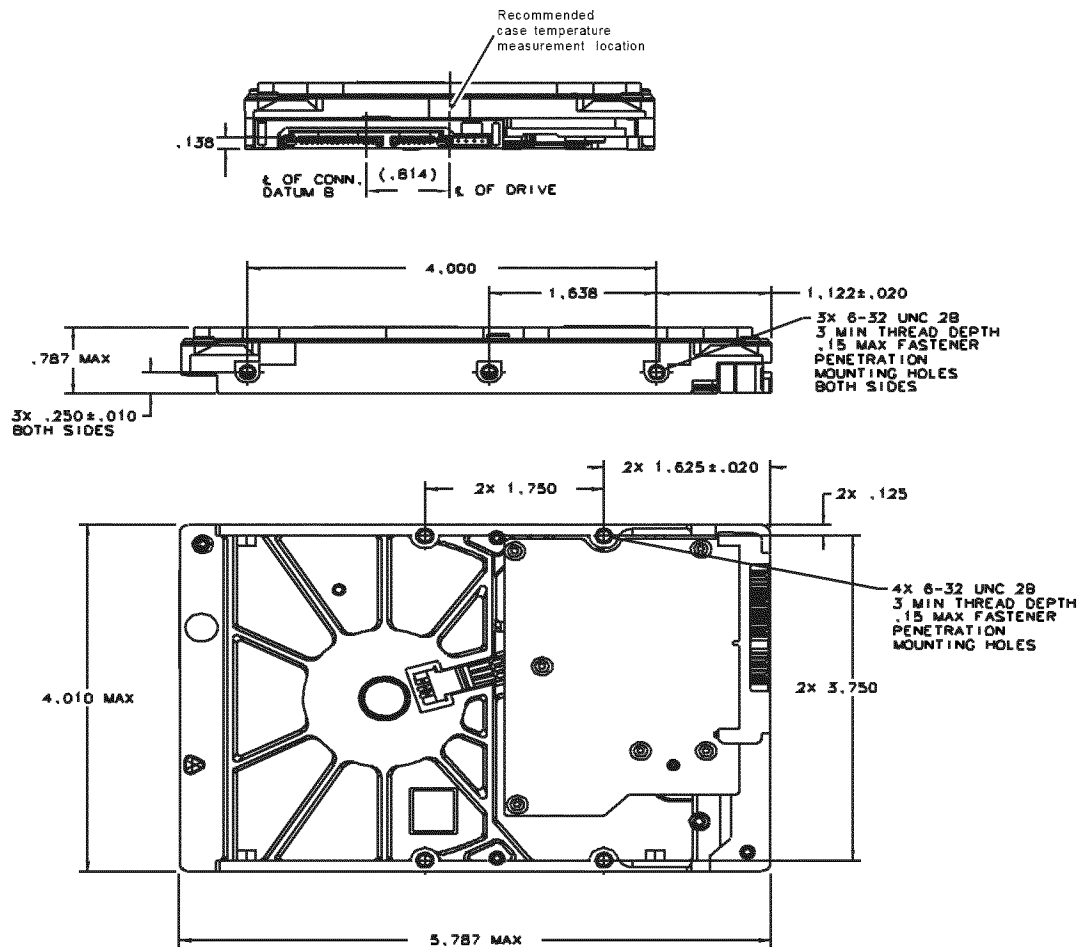
Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2 Mounting dimensions (3-disk: 3TB, 2TB; 2-disk: 1.5TB models)**





**Figure 3 Mounting dimensions (1-disk: 1TB and 750GB models)**

**Figure 4 Mounting dimensions (1-disk: 500GB, 320GB and 250GB models)**

## 4.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6. For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 4.1 Hot-Plug compatibility

Barracuda drives incorporate connectors which enable you to hot plug these drives in accordance with the SATA Revision 3.0 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 4.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATA connector pin definitions

Segment	Pin	Function	Definition
<b>Signal</b>	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			

**Table 9 SATA connector pin definitions (continued)**

Segment	Pin	Function	Definition
<b>Power</b>	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

**Notes**

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:  
the ground pins P4 and P12.  
the pre-charge power pins and the other ground pins.  
the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.  
All used voltage pins (V<sub>x</sub>) must be terminated.

**4.3 Supported ATA commands**

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 38 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 10 SATA standard commands**

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>

**Table 10 SATA standard commands (continued)**

<b>Command name</b>	<b>Command code (in hex)</b>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address	F9 <sub>H</sub>

**Table 10 SATA standard commands (continued)**

<b>Command name</b>  Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	<b>Command code (in hex)</b>  Address: 00 <sub>H</sub> Password: 01 <sub>H</sub> Lock: 02 <sub>H</sub> Unlock: 03 <sub>H</sub> Freeze Lock: 04 <sub>H</sub>
Set Max Address Extended	37 <sub>H</sub>
Set Multiple Mode	C6 <sub>H</sub>
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S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>
Standby	E2 <sub>H</sub>
Standby Immediate	E0 <sub>H</sub>
Write Buffer	E8 <sub>H</sub>
Write DMA	CA <sub>H</sub>
Write DMA Extended	35 <sub>H</sub>
Write DMA FUA Extended	3D <sub>H</sub>
Write DMA Without Retries	CB <sub>H</sub>
Write Log Extended	3F <sub>H</sub>
Write Multiple	C5 <sub>H</sub>
Write Multiple Extended	39 <sub>H</sub>
Write Multiple FUA Extended	CE <sub>H</sub>
Write Sectors	30 <sub>H</sub>
Write Sectors Without Retries	31 <sub>H</sub>
Write Sectors Extended	34 <sub>H</sub>
Write Uncorrectable	45 <sub>H</sub>

### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 30. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>

**Table 11 Identify Device commands (continued)**

Word	Description	Value
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100-103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>



**Table 11 Identify Device commands (continued)**

Word	Description	Value
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFh.	ST3000DM001 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

**Note**

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

**Note**

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.

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	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.
	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note**

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 4.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 13 S.M.A.R.T. commands**

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

**Note**

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.

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# Exhibit 7



Product Manual

# Barracuda®

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

Gen 14  
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Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.

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For information regarding data recovery services, visit <http://www.i365.com>

For Seagate OEM and Distribution partner portal, visit <https://direct.seagate.com/portal/system>

For Seagate reseller portal, visit <http://spp.seagate.com>



## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following Seagate Barracuda® model drives:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queueing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors.
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

### 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow you to install a SATA host adapter and SATA disk drive in your current system and expect all of your existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

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The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

**Note**

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001; ST2000DM001	ST2000DM001; ST1500DM003	ST1000DM003; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1807kFCI	1807kFCI	1807kFCI
Track density (avg)	352ktracks/in	352ktracks/in	352ktracks/in
Areal density (avg)	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	2147Mb/s	2147Mb/s	2147Mb/s
Average data rate, read/write (MB/s)	156MB/s	156MB/s	156MB/s
Maximum sustained data rate, OD read (MB/s)	210MB/s	210MB/s	210MB/s
I/O data-transfer rate (max)	600MB/s	600MB/s	600MB/s
Cache buffer	64MB	64MB	64MB
Height (max)	26.1mm / 1.028 in	26.1mm / 1.028 in	20.17mm / 0.7825 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<17.0s	<17.0s	<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s	<10.0s	n/a

## Drive Specifications

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**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001; ST2000DM001	ST2000DM001; ST1500DM003	ST1000DM003; ST750DM003
Standby to ready (max)	<17.0s	<17.0s	<10.0s
Average seek, read (typical)	<8.5ms typical	<8.5ms (read)	<8.5ms (read)
Average seek, write (typical)	<9.5ms typical	<9.5ms (write)	<9.5ms (write)
Startup current (typical) 12V	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C max (operating) 40.0°C max (non-operating)
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)
Operational shock (max)	80 Gs at 2ms	80 Gs at 2ms	80 Gs at 2ms
Non-operational shock (max)	300 Gs at 2ms	300 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs
Drive acoustics, sound power			
Idle***	ST3000DM001; ST2000DM001 2.4 bels (typical) 2.6 bels (max)	ST2000DM001; ST1500DM003 2.4 bels (typical) 2.6 bels (max)	ST1000DM003; ST750DM003 2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)	2.6 bels (typical) 2.7 bels (max)	2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> . From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000	300,000	300,000
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2	2	1
Disks	1	1	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1413kb/in	1413kb/in	1413kb/in
Track density (avg)	236ktracks/in	236ktracks/in	236ktracks/in
Areal density (avg)	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	1695Mb/s	1695Mb/s	1695Mb/s
Average Data Rate, read/write (MB/s)	125MB/s	125MB/s	125MB/s
Maximum sustained data transfer rate, OD read (MB/s)	144MB/s	144MB/s	144MB/s
I/O data-transfer rate (max.)	600MB/s	600MB/s	600MB/s
Cache buffer	16MB	16MB	16MB
Height (max)	19.98mm / 0.787 in	19.98mm / 0.787 in	19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	415g / 0.915 lb	415g / 0.915 lb	415g / 0.915 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<8.5s	<8.5s	<8.5s
Power-on to ready, 2.5A spin-up code option (typical)	n/a	n/a	n/a
Standby to ready (max)	<8.5s	<8.5s	<8.5s
Average seek, read (typical)	<8.5ms (read)	<8.5ms (read)	<8.5ms (read)
Average seek, write (typical)	<9.5ms (write)	<9.5ms (write)	<9.5ms (write)
Startup current (typical) 12V	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)



## Drive Specifications

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**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Operational shock (max)	70 Gs at 2ms	70 Gs at 2ms	70 Gs at 2ms
Non-operational shock (max)	350 Gs at 2ms	350 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)
Seek	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001	3000GB	5,860,533,168	4k
ST2000DM001	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

## 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600

## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB and 750GB	20.17mm / 0.7825 in
500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in ( ± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

<b>Typical seek times (ms)</b>	<b>Read</b>	<b>Write</b>
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

**Note**

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	<b>3-disk</b> (3TB, 2TB models)	<b>2-disk</b> (2TB, 1.5TB models)	<b>1-disk</b> (1TB, 750GB models)	<b>1-disk</b> (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10	<10	n/a	n/a
Standby to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 26**.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3**, **Table 4**, **Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

<b>Power dissipation (3-disk values shown)</b>	<b>Avg (watts 25° C)</b>	<b>Avg 5V typ amps</b>	<b>Avg 12V typ amps</b>
Spinup	—	—	2.0
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005

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**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

Sleep	0.75	0.136	0.005
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**Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

**Note**

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

### 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V

±5%

12V

+10% / -7.5%

### 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

#### Active mode

The drive is in Active mode during the read/write and seek operations.

#### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

#### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

#### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

### 2.9.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 69°C (156°F) within the operating ambient conditions. Refer to **Section 3.4 on page 26** for base plate measurement location.

<b>Operating</b>	0° to 60°C (32° to 140°F)
<b>Non-operating</b>	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

<b>Operating</b>	20°C per hour (68°F per hour max), without condensation
<b>Non-operating</b>	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

<b>Operating</b>	5% to 95% non-condensing (30% per hour max)
<b>Nonoperating</b>	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

<b>Operating</b>	37.7°C (99.9°F max)
<b>Non-operating</b>	40°C (104°F max)

### 2.9.4 Altitude

<b>Operating</b>	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
<b>Non-operating</b>	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

### 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

#### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

#### 2.9.5.2 Non-operating shock

##### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

**1TB, 750GB, 500GB, 320GB and 250GB models**

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

**2.9.5.3 Operating vibration**

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

**2.9.6 Non-operating vibration**

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

**2.10 Acoustics**

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note**

For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

(Number of seeks per second =  $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (2TB, 1.5TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.



## 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in Table 8.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:  
[support.seagate.com/customer/warranty\\_validation.jsp](http://support.seagate.com/customer/warranty_validation.jsp)

From this page, click on the “Verify Your Warranty” link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.

## 2.13 Agency certification

### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

**Korean RRL**

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

**Australian C-Tick (N176)**

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

**2.13.3FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

**2.14 Environmental protection**

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

**2.14.1European Union Restriction of Hazardous Substances (RoHS) Directive**

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

**2.14.2 China Restriction of Hazardous Substances (RoHS) Directive** 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

**2.15 Corrosive environment**

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

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This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until you mount it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

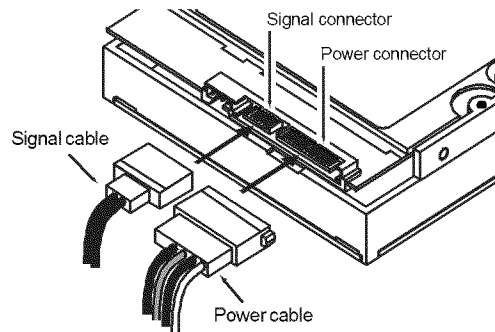
SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if you connect the drive and receive a “drive not detected” error, your SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See [Table 9](#) for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, you can connect the drive as illustrated in [Figure 1](#).

**Figure 1 Attaching SATA cabling**

Each cable is keyed to ensure correct orientation. Barracuda drives support latching SATA connectors.

### 3.4 Drive mounting

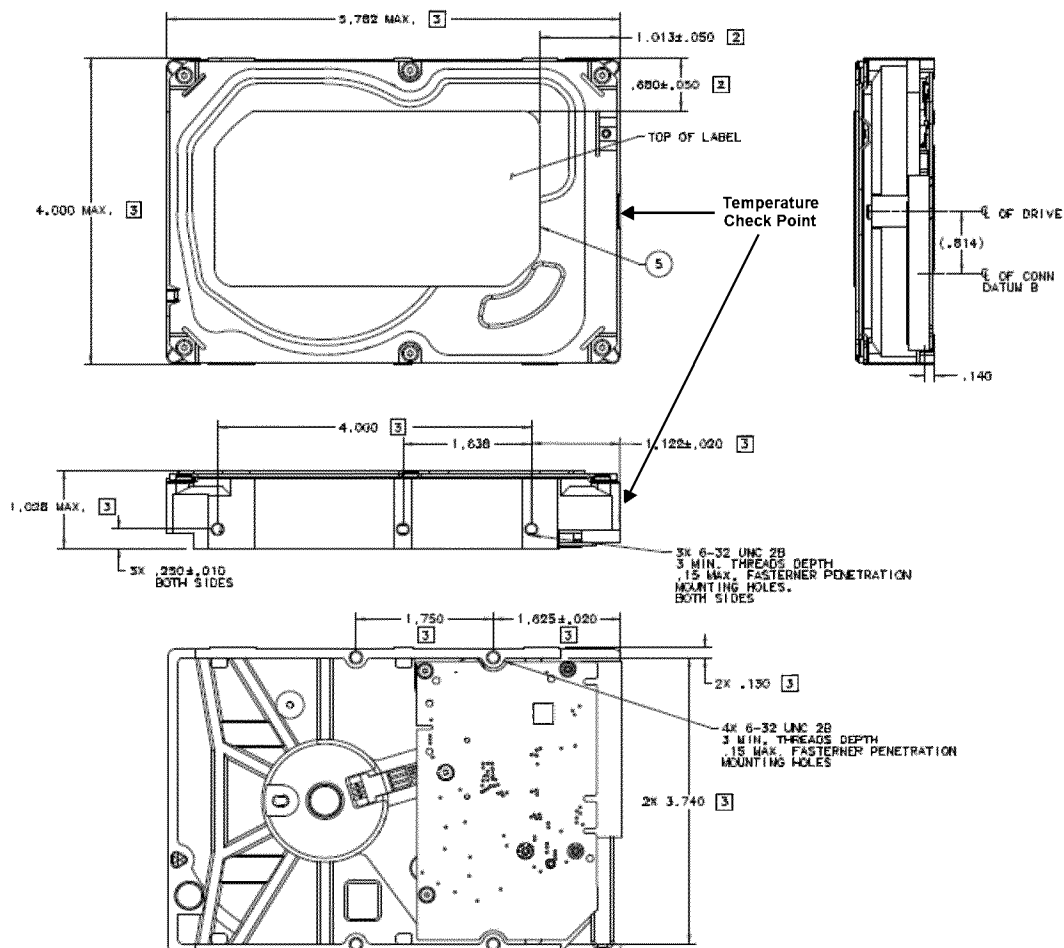
You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2**, **Figure 3**, and **Figure 4** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

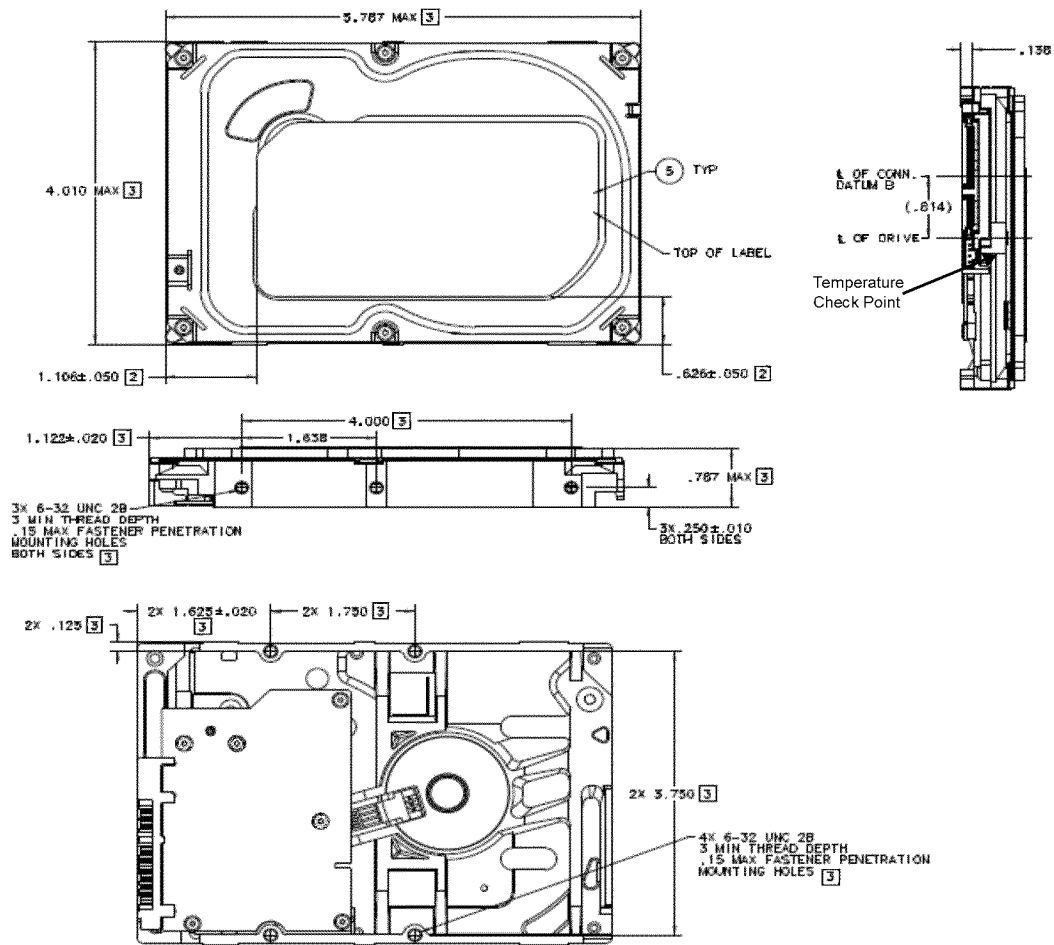
Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

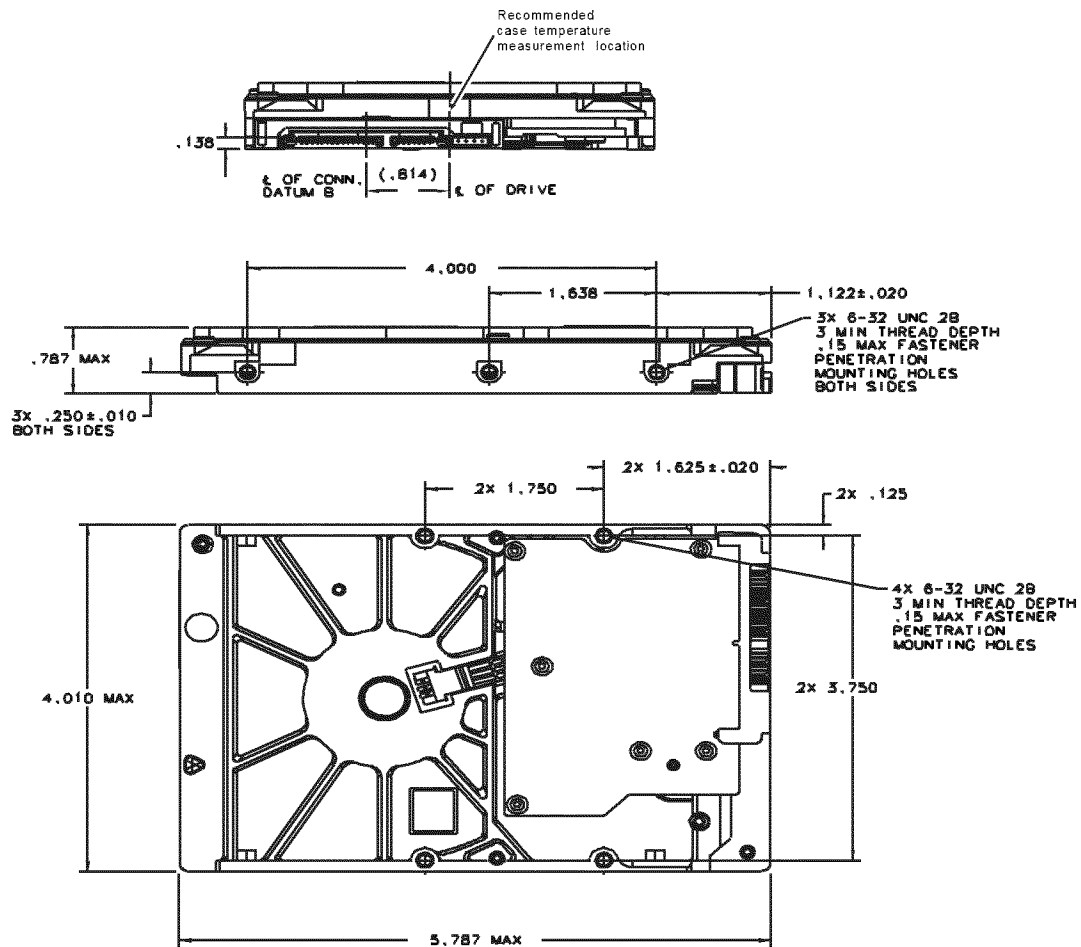
Use only 6-32 UNC mounting screws.

The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.

Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2 Mounting dimensions (3-disk: 3TB, 2TB; 2-disk: 2TB, 1.5TB models)**

**Figure 3 Mounting dimensions (1-disk: 1TB and 750GB models)**

**Figure 4 Mounting dimensions (1-disk: 500GB, 320GB and 250GB models)**

## 4.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6. For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 4.1 Hot-Plug compatibility

Barracuda drives incorporate connectors which enable you to hot plug these drives in accordance with the SATA Revision 3.0 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 4.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATA connector pin definitions

Segment	Pin	Function	Definition
<b>Signal</b>	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			



**Table 9 SATA connector pin definitions (continued)**

Segment	Pin	Function	Definition
<b>Power</b>	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

**Notes**

1. All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
2. The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:  
the ground pins P4 and P12.  
the pre-charge power pins and the other ground pins.  
the signal pins and the rest of the power pins.
3. There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.  
All used voltage pins (V<sub>x</sub>) must be terminated.

**4.3 Supported ATA commands**

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 38 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 10 SATA standard commands**

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>

**Table 10 SATA standard commands (continued)**

Command name	Command code (in hex)
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address	F9 <sub>H</sub>

**Table 10 SATA standard commands (continued)**

<b>Command name</b>  Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	<b>Command code (in hex)</b>  Address: 00 <sub>H</sub> Password: 01 <sub>H</sub> Lock: 02 <sub>H</sub> Unlock: 03 <sub>H</sub> Freeze Lock: 04 <sub>H</sub>
Set Max Address Extended	37 <sub>H</sub>
Set Multiple Mode	C6 <sub>H</sub>
Sleep	E6 <sub>H</sub>
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>
Standby	E2 <sub>H</sub>
Standby Immediate	E0 <sub>H</sub>
Write Buffer	E8 <sub>H</sub>
Write DMA	CA <sub>H</sub>
Write DMA Extended	35 <sub>H</sub>
Write DMA FUA Extended	3D <sub>H</sub>
Write DMA Without Retries	CB <sub>H</sub>
Write Log Extended	3F <sub>H</sub>
Write Multiple	C5 <sub>H</sub>
Write Multiple Extended	39 <sub>H</sub>
Write Multiple FUA Extended	CE <sub>H</sub>
Write Sectors	30 <sub>H</sub>
Write Sectors Without Retries	31 <sub>H</sub>
Write Sectors Extended	34 <sub>H</sub>
Write Uncorrectable	45 <sub>H</sub>

### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 30. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>

**Table 11 Identify Device commands (continued)**

Word	Description	Value
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100-103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>

**Table 11 Identify Device commands (continued)**

Word	Description	Value
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFh.	ST3000DM001 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

**Note**

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

**Note**

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.

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	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.
	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note**

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.



### 4.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 13 S.M.A.R.T. commands**

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

**Note**

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.

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# Exhibit 8





Product Manual

# Barracuda<sup>®</sup>

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

Gen 14  
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Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).

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## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following Seagate Barracuda® model drives:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queueing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors.
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

### 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow you to install a SATA host adapter and SATA disk drive in your current system and expect all of your existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

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The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

**Note**

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001; ST2000DM001	ST2000DM001; ST1500DM003	ST1000DM003; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1807kFCI	1807kFCI	1807kFCI
Track density (avg)	352ktracks/in	352ktracks/in	352ktracks/in
Areal density (avg)	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>	625Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	2147Mb/s	2147Mb/s	2147Mb/s
Average data rate, read/write (MB/s)	156MB/s	156MB/s	156MB/s
Maximum sustained data rate, OD read (MB/s)	210MB/s	210MB/s	210MB/s
I/O data-transfer rate (max)	600MB/s	600MB/s	600MB/s
Cache buffer	64MB	64MB	64MB
Height (max)	26.1mm / 1.028 in	26.1mm / 1.028 in	20.17mm / 0.7825 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<17.0s	<17.0s	<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s	<10.0s	n/a

## Drive Specifications

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**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001; ST2000DM001	ST2000DM001; ST1500DM003	ST1000DM003; ST750DM003
Standby to ready (max)	<17.0s	<17.0s	<10.0s
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical	<8.5ms (read) <9.5ms (write)	<8.5ms (read) <9.5ms (write)
Startup current 12V	2.0A or 2.8A	2.0A or 2.8A	2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C max (operating) 40.0°C max (non-operating)
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)
Operational shock (max)	80 Gs at 2ms	80 Gs at 2ms	80 Gs at 2ms
Non-operational shock (max)	300 Gs at 2ms	300 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs
Drive acoustics, sound power			
Idle***	ST3000DM001; ST2000DM001 2.4 bels (typical) 2.6 bels (max)	ST2000DM001; ST1500DM003 2.4 bels (typical) 2.6 bels (max)	ST1000DM003; ST750DM003 2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)	2.6 bels (typical) 2.7 bels (max)	2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Rated workload	Average rate of <55TB/year. The MTBF specification for the drive assumes the I/O workload does not exceed the average annualized workload rate limit of 55TB/year. Workloads exceeding the annualized rate may degrade the drive MTBF and impact product reliability. The average annualized workload rate limit is in units of TB per year, or TB per 8760 power-on hours. Workload rate limit = TB transferred × (8760/recorded power-on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> . From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000	300,000	300,000
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2	2	1
Disks	1	1	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096	4096	4096
Default sectors per track	63	63	63
Default read/write heads	16	16	16
Default cylinders	16,383	16,383	16,383
Recording density (max)	1413kb/in	1413kb/in	1413kb/in
Track density (avg)	236ktracks/in	236ktracks/in	236ktracks/in
Areal density (avg)	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>	329Gb/in <sup>2</sup>
Spindle speed	7200 RPM	7200 RPM	7200 RPM
Internal data transfer rate (max)	1695Mb/s	1695Mb/s	1695Mb/s
Average Data Rate, read/write (MB/s)	125MB/s	125MB/s	125MB/s
Maximum sustained data transfer rate, OD read (MB/s)	144MB/s	144MB/s	144MB/s
I/O data-transfer rate (max.)	600MB/s	600MB/s	600MB/s
Cache buffer	16MB	16MB	16MB
Height (max)	19.98mm / 0.787 in	19.98mm / 0.787 in	19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)	101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in	146.99mm / 5.787 in	146.99mm / 5.787 in
Weight (typical)	415g / 0.915 lb	415g / 0.915 lb	415g / 0.915 lb
Average latency	4.16ms	4.16ms	4.16ms
Power-on to ready (max)	<8.5s	<8.5s	<8.5s
Power-on to ready, 2.5A spin-up code option (typical)	n/a	n/a	n/a
Standby to ready (max)	<8.5s	<8.5s	<8.5s
Average seek, read (typical)	<8.5ms (read)	<8.5ms (read)	<8.5ms (read)
Average seek, write (typical)	<9.5ms (write)	<9.5ms (write)	<9.5ms (write)
Startup current (typical) 12V	2.0A	2.0A	2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%	5V: ±5% 12V: +10% / -7.5%
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)	0° to 60°C (operating) -40° to 70°C (non-operating)
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)	20°C per hour max (operating) 30°C per hour max (non-operating)
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)	5% to 95% (operating) 5% to 95% (non-operating)
Relative humidity gradient (max)	30% per hour	30% per hour	30% per hour
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)	37.7°C (operating) 40.0°C (non-operating)
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)	-304.8m to 3048m (-1000 ft to 10,000+ ft)
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)

## Drive Specifications

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**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Operational shock (max)	70 Gs at 2ms	70 Gs at 2ms	70 Gs at 2ms
Non-operational shock (max)	350 Gs at 2ms	350 Gs at 2ms	350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)	2.2 bels (typical) 2.3 bels (max)
Seek	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)	2.3 bels (typical) 2.4 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read	1 per 10 <sup>14</sup> bits read
Rated workload	Average rate of <55TB/year. The MTBF specification for the drive assumes the I/O workload does not exceed the average annualized workload rate limit of 55TB/year. Workloads exceeding the annualized rate may degrade the drive MTBF and impact product reliability. The average annualized workload rate limit is in units of TB per year, or TB per 8760 power-on hours. Workload rate limit = TB transferred × (8760/recorded power-on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://support.seagate.com/customer/warranty_validation.jsp">support.seagate.com/customer/warranty_validation.jsp</a> . From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity	50,000 at 25°C, 50% rel. humidity
Supports Hotplug operation per the Serial ATA Revision 3.0 specification	Yes	Yes	Yes

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**2.2 Formatted capacity**

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001	3000GB	5,860,533,168	4k
ST2000DM001	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

## 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

## 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600

## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB and 750GB	20.17mm / 0.7825 in
500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in ( ± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

### Note

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.



## 2.7 Start/stop times

	<b>3-disk</b> (3TB, 2TB models)	<b>2-disk</b> (2TB, 1.5TB models)	<b>1-disk</b> (1TB, 750GB models)	<b>1-disk</b> (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10	<10	n/a	n/a
Standby to ready (in seconds)	15 (typical) 17 (max)	15 (typical) 17 (max)	10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)	10 (typical) 11 (max)

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 26**.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3**, **Table 4**, **Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

**Note**

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

## 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V

±5%

12V

+10% / -7.5%

## 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

### Active mode

The drive is in Active mode during the read/write and seek operations.

### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive

activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

### 2.9.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 69°C (156°F) within the operating ambient conditions. Refer to **Section 3.4 on page 26** for base plate measurement location.

<b>Operating</b>	0° to 60°C (32° to 140°F)
<b>Non-operating</b>	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

<b>Operating</b>	20°C per hour (68°F per hour max), without condensation
<b>Non-operating</b>	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

<b>Operating</b>	5% to 95% non-condensing (30% per hour max)
<b>Nonoperating</b>	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

<b>Operating</b>	37.7°C (99.9°F max)
<b>Non-operating</b>	40°C (104°F max)

### 2.9.4 Altitude

<b>Operating</b>	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
<b>Non-operating</b>	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

### 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

#### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

**2.9.5.2 Non-operating shock****3TB, 2TB and 1.5TB models**

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

**1TB, 750GB, 500GB, 320GB and 250GB models**

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

**2.9.5.3 Operating vibration**

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

**2.9.6 Non-operating vibration**

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

**2.10 Acoustics**

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note**

For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

(Number of seeks per second =  $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (2TB, 1.5TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics (continued)**

<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)
-------------------------------------------	--------------------------------------	--------------------------------------

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

### 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

### 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in [Table 8](#).

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

### 2.12 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:  
[support.seagate.com/customer/warranty\\_validation.jsp](http://support.seagate.com/customer/warranty_validation.jsp)

From this page, click on the “Verify Your Warranty” link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.

### 2.13 Agency certification

#### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

## 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

### Korean RRL

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

### Australian C-Tick (N176)

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

## 2.13.3 FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

## 2.14 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

### 2.14.1 European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

### 2.14.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

## 2.15 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.



## 3.0 Configuring and Mounting the Drive

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This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until you mount it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

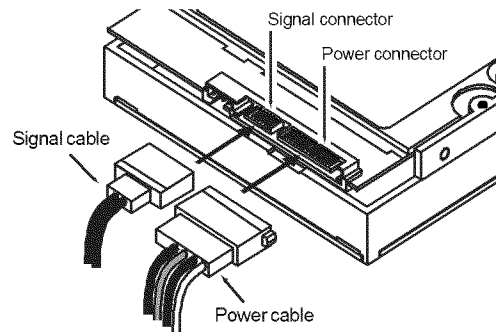
SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if you connect the drive and receive a “drive not detected” error, your SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See [Table 9](#) for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, you can connect the drive as illustrated in [Figure 1](#).

**Figure 1 Attaching SATA cabling**

Each cable is keyed to ensure correct orientation. Barracuda drives support latching SATA connectors.

### 3.4 Drive mounting

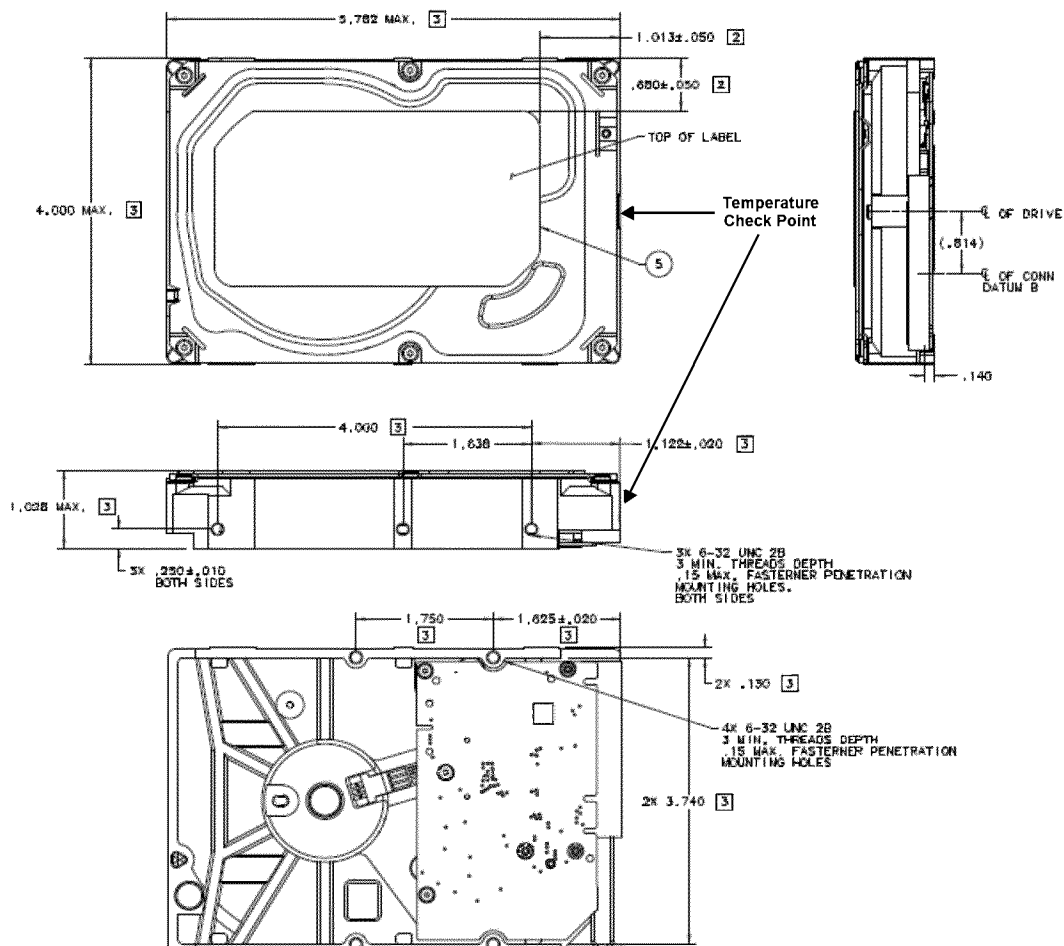
You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2**, **Figure 3**, and **Figure 4** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

Use only 6-32 UNC mounting screws.

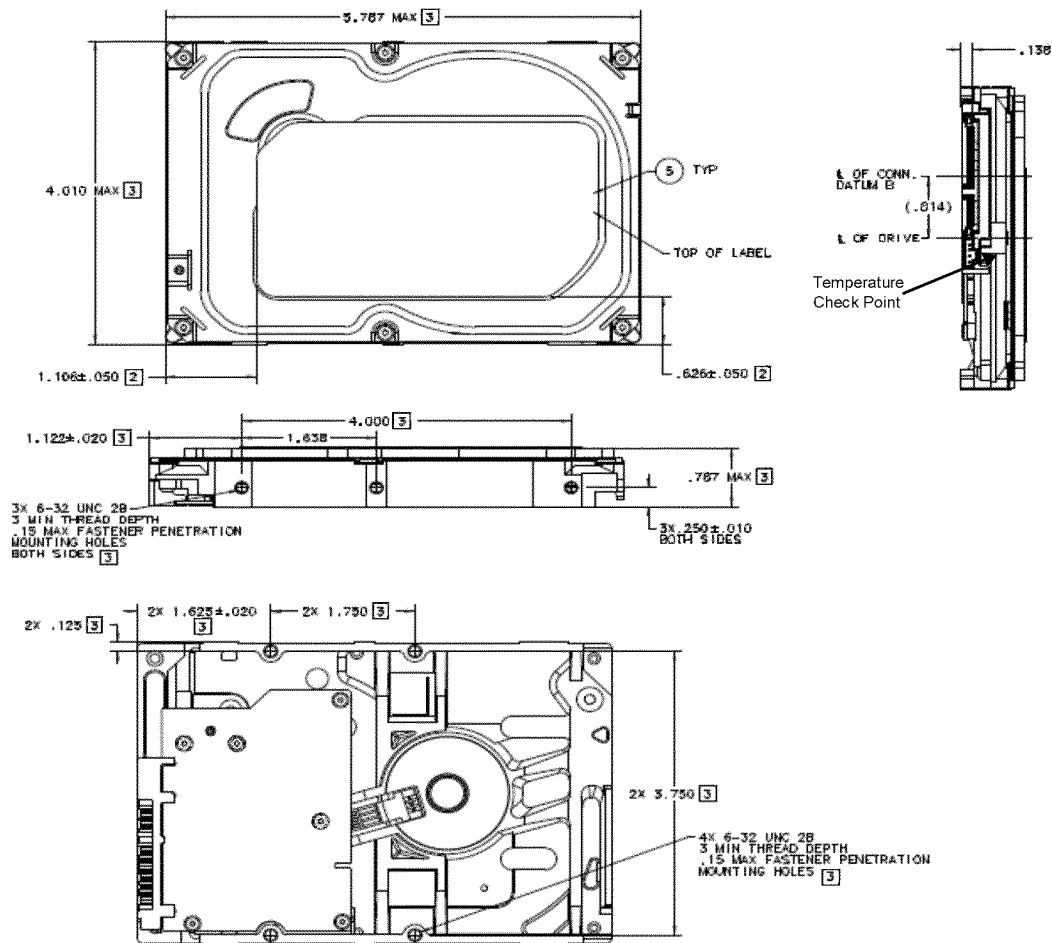
The screws should be inserted no more than 0.150 inch (3.81 mm) into the bottom or side mounting holes.

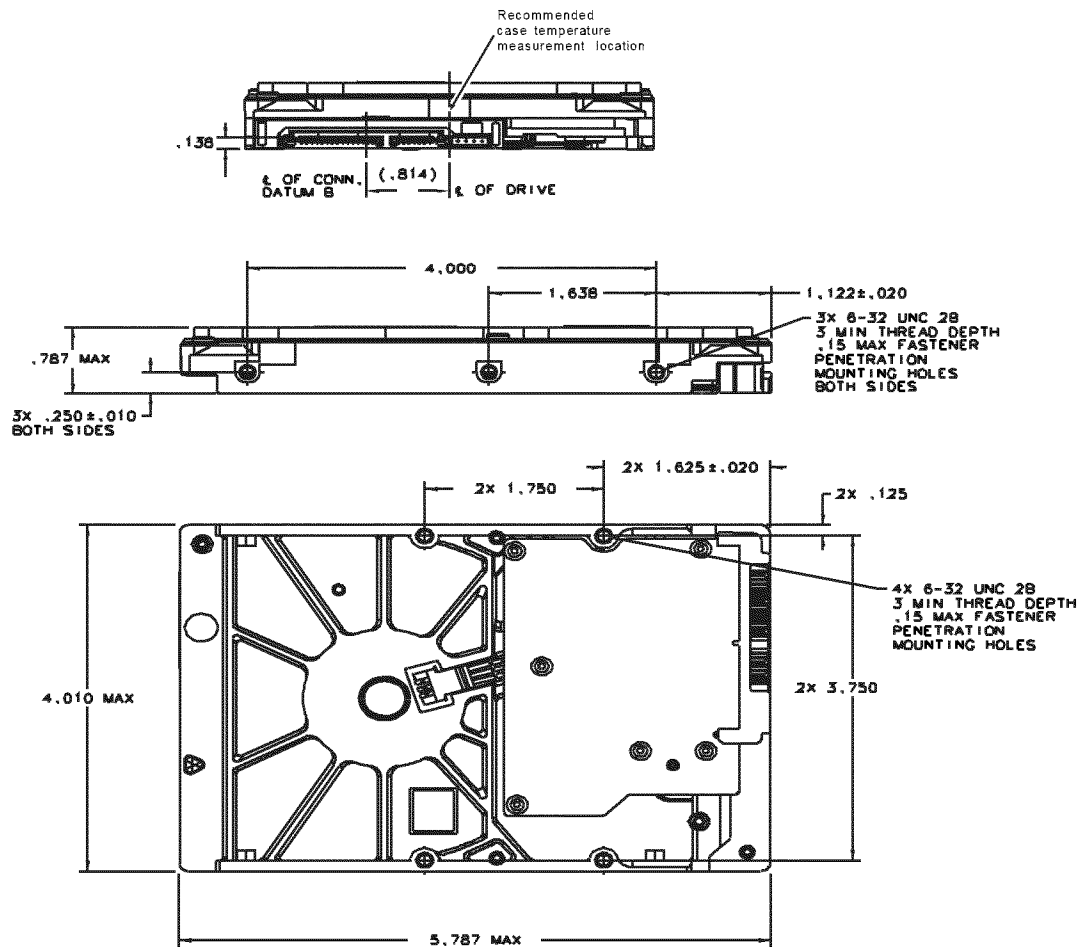
Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2 Mounting dimensions (3-disk: 3TB, 2TB; 2-disk: 2TB, 1.5TB models)**

## Configuring and Mounting the Drive

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**Figure 3 Mounting dimensions (1-disk: 1TB and 750GB models)**

**Figure 4 Mounting dimensions (1-disk: 500GB, 320GB and 250GB models)**

## 4.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6. For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 4.1 Hot-Plug compatibility

Barracuda drives incorporate connectors which enable you to hot plug these drives in accordance with the SATA Revision 3.0 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 4.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATA connector pin definitions

Segment	Pin	Function	Definition
<b>Signal</b>	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			

**Table 9 SATA connector pin definitions (continued)**

Segment	Pin	Function	Definition
<b>Power</b>	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

**Notes**

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:  
the ground pins P4 and P12.  
the pre-charge power pins and the other ground pins.  
the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.  
All used voltage pins (V<sub>x</sub>) must be terminated.

**4.3 Supported ATA commands**

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 38 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 10 SATA standard commands**

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>

**Table 10 SATA standard commands (continued)**

Command name	Command code (in hex)
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address	F9 <sub>H</sub>

**Table 10 SATA standard commands (continued)**

Command name  Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Command code (in hex)  Address: 00 <sub>H</sub> Password: 01 <sub>H</sub> Lock: 02 <sub>H</sub> Unlock: 03 <sub>H</sub> Freeze Lock: 04 <sub>H</sub>
Set Max Address Extended	37 <sub>H</sub>
Set Multiple Mode	C6 <sub>H</sub>
Sleep	E6 <sub>H</sub>
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>
Standby	E2 <sub>H</sub>
Standby Immediate	E0 <sub>H</sub>
Write Buffer	E8 <sub>H</sub>
Write DMA	CA <sub>H</sub>
Write DMA Extended	35 <sub>H</sub>
Write DMA FUA Extended	3D <sub>H</sub>
Write DMA Without Retries	CB <sub>H</sub>
Write Log Extended	3F <sub>H</sub>
Write Multiple	C5 <sub>H</sub>
Write Multiple Extended	39 <sub>H</sub>
Write Multiple FUA Extended	CE <sub>H</sub>
Write Sectors	30 <sub>H</sub>
Write Sectors Without Retries	31 <sub>H</sub>
Write Sectors Extended	34 <sub>H</sub>
Write Uncorrectable	45 <sub>H</sub>



### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 30. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>

**Table 11 Identify Device commands (continued)**

Word	Description	Value
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100-103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>

**Table 11 Identify Device commands (continued)**

Word	Description	Value
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFh.	ST3000DM001 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

**Note**

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

**Note**

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.

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	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.
	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note**

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 4.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 13 S.M.A.R.T. commands**

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

**Note**

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.

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## Exhibit 9



Product Manual

Barracuda®

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

Gen 14  
100686584  
Rev. H  
March 2014

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Revision	Date	Description of Change
Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)

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For Seagate reseller portal, visit: <http://www.seagate.com/partners/my-spp-dashboard/>

## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following Seagate Barracuda® HDD model drives:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queueing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors.
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

## 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.

- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.

- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

---

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

---

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001; ST2000DM001	ST2000DM001; ST1500DM003	ST1000DM003; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in		146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical		
Startup current 12V	2.0A or 2.8A		2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001; ST2000DM001	ST2000DM001; ST1500DM003	ST1000DM003; ST750DM003
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.4 bels (typical) 2.6 bels (max)		2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)		2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Rated workload	Average rate of <55TB/year. The AFR specification for the drive assumes the I/O workload does not exceed the average annualized workload rate limit of 55TB/year. Workloads exceeding the annualized rate may degrade the drive AFR and impact product reliability. The average annualized workload rate limit is in units of TB per year, or TB per 8760 power-on hours. Workload rate limit = TB transferred × (8760/recorded power-on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2		1
Disks	1		
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1413kb/in		
Track density (avg)	236ktracks/in		
Areal density (avg)	329Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	1695Mb/s		
Average Data Rate, read/write (MB/s)	125MB/s		
Maximum sustained data transfer rate, OD read (MB/s)	144MB/s		
I/O data-transfer rate (max.)	600MB/s		
Cache buffer	16MB		
Height (max)	19.98mm / 0.787 in		
Width (max)	101.6mm / 4.0 in ( $\pm 0.010$ in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	415g / 0.915 lb		
Average latency	4.16ms		
Power-on to ready (max)	<8.5s		
Power-on to ready, 2.5A spin-up code option (typical)	n/a		
Standby to ready (max)	<8.5s		
Average seek, read (typical)	<8.5ms (read)		
Average seek, write (typical)	<9.5ms (write)		
Startup current (typical) 12V	2.0A		
Voltage tolerance (including noise)	5V: $\pm 5\%$ 12V: $+10\%$ / $-7.5\%$		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms		
Non-operational shock (max)	350 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		

**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.2 bels (typical) 2.3 bels (max)		
Seek	2.3 bels (typical) 2.4 bels (max)		
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Rated workload	Average rate of <55TB/year. The AFR specification for the drive assumes the I/O workload does not exceed the average annualized workload rate limit of 55TB/year. Workloads exceeding the annualized rate may degrade the drive AFR and impact product reliability. The average annualized workload rate limit is in units of TB per year, or TB per 8760 power-on hours. Workload rate limit = TB transferred × (8760/recorded power-on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001	3000GB	5,860,533,168	4K
ST2000DM001	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.



### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

### 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

#### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

### 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600

## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB, 750GB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in ( $\pm 0.010$ in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	3-disk (3TB, 2TB models)	2-disk (2TB, 1.5TB models)	1-disk (1TB, 750GB models)	1-disk (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 19**.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3, Table 4, Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

## 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V  $\pm 5\%$

12V  $+10\%$  /  $-7.5\%$

## 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

### Active mode

The drive is in Active mode during the read/write and seek operations.

### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.

Refer to Section 3.4 on page 20 for base plate measurement location.

### 2.9.1 Ambient temperature

Operating	0° to 60°C (32° to 140°F)
Non-operating	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

Operating	20°C per hour (68°F per hour max), without condensation
Non-operating	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

Operating	5% to 95% non-condensing (30% per hour max)
Nonoperating	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

Operating	37.7°C (99.9°F max)
Non-operating	40°C (104°F max)

### 2.9.4 Altitude

Operating	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
Non-operating	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

Maximum storage condition not to exceed 90 days at a wetbulb temperature of 32°C (example: 34°C / 90& RH)

## 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

### 2.9.5.2 Non-operating shock

#### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

#### 1TB, 750GB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

### 2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

## 2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs



## 2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

	For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:
	$(\text{Number of seeks per second} = 0.4 / (\text{average latency} + \text{average access time}))$

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (2TB, 1.5TB)		
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

### 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in Table 8.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94



## 2.12 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:  
<http://www.seagate.com/support/warranty-and-replacements/>

From this page, click on “Check to see if the drive is under Warranty”. Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.

## 2.13 Agency certification

### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

#### Korean RRL

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

#### Australian C-Tick (N176)

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

### 2.13.3FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

### 2.14 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

#### 2.14.1European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

**2.14.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令**

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

**2.15 Corrosive environment**

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until mounting it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

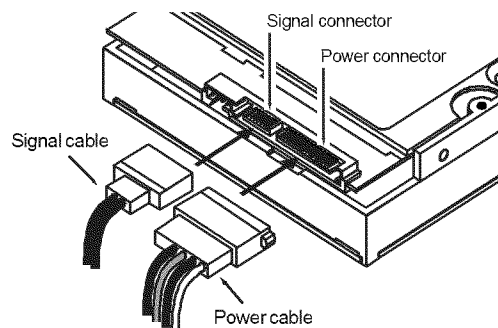
### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See **Table 9** for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in **Figure 1**.

**Figure 1** Attaching SATA cabling



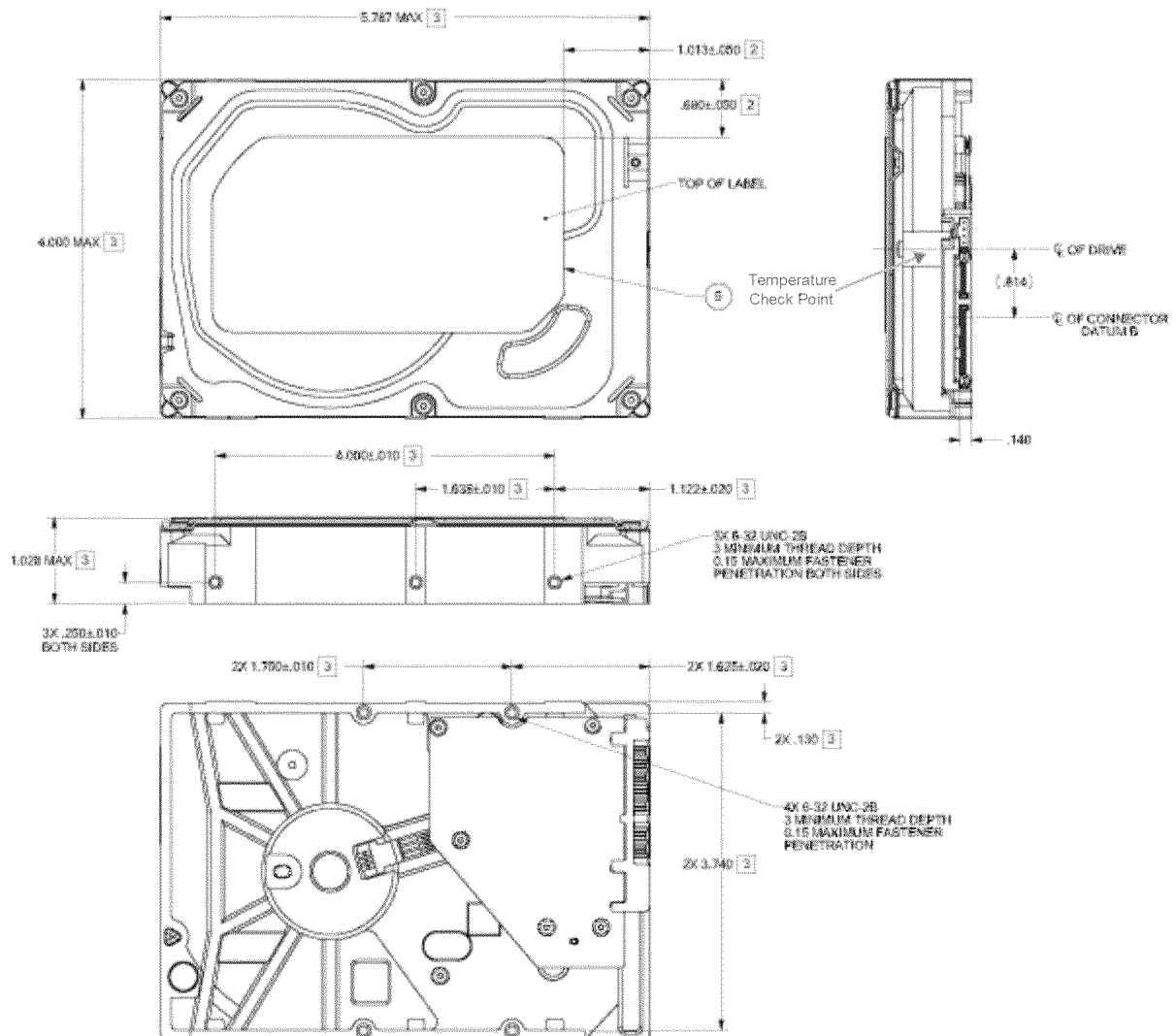
Each cable is keyed to ensure correct orientation. Barracuda drives support latching SATA connectors.

### 3.4 Drive mounting

Users can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2** and **Figure 3** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

- Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.
- Use only 6-32 UNC mounting screws.
- The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.
- Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

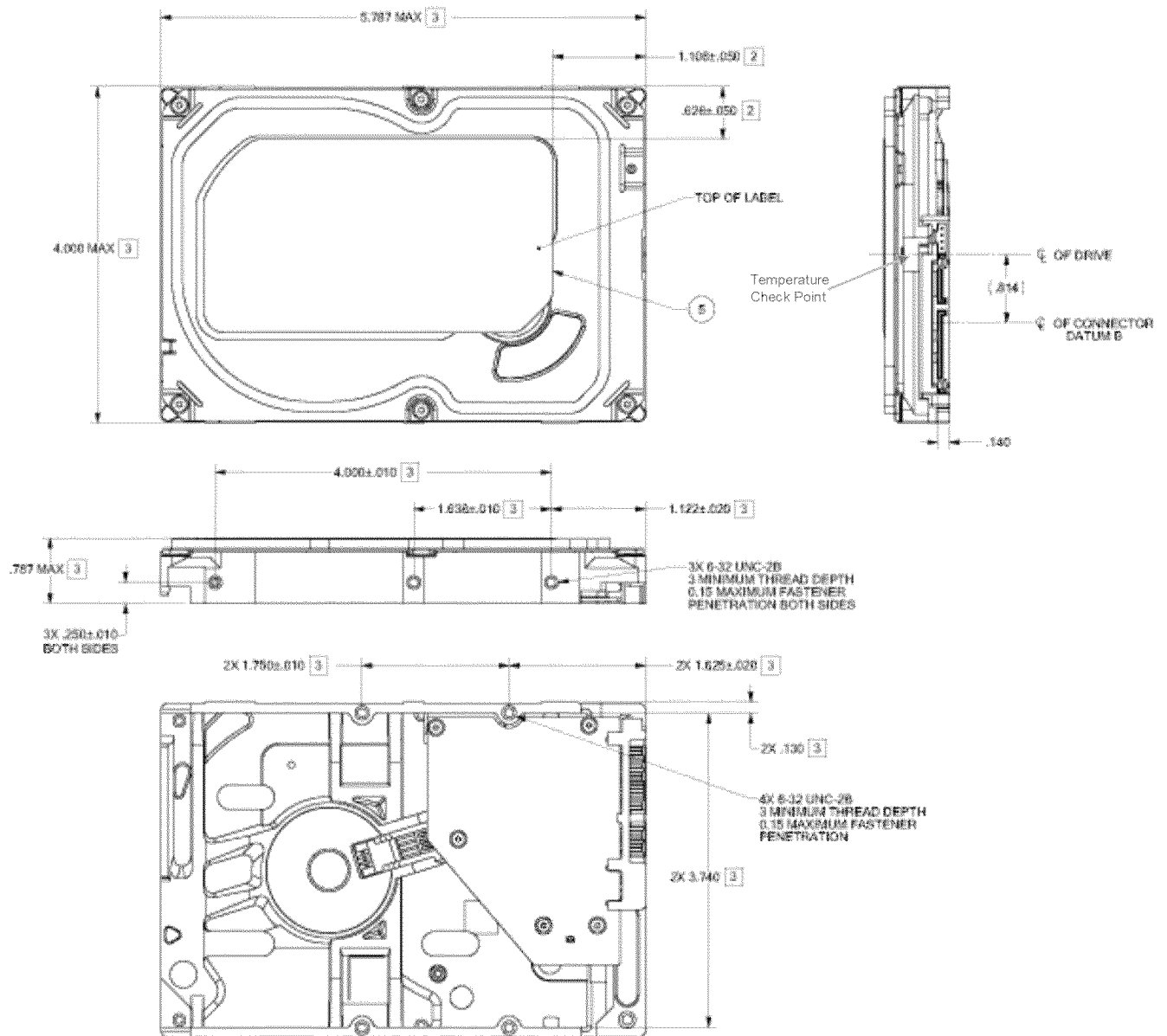
**Figure 2** Mounting dimensions (3-disk: 1.5TB to 3TB models)



Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.



Figure 3 Mounting dimensions (1-disk: 250GB to 1TB models)



Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.

## 4.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 4.1 Hot-Plug compatibility

Barracuda drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.0 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 4.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATA connector pin definitions

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			
Power	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

#### Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
  - All used voltage pins (V<sub>x</sub>) must be terminated.

### 4.3 Supported ATA commands

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 30 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 10 SATA standard commands**

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>



Table 10 SATA standard commands (continued)

Command name	Command code (in hex)										
Security Freeze	F5 <sub>H</sub>										
Security Set Password	F1 <sub>H</sub>										
Security Unlock	F2 <sub>H</sub>										
Seek	70 <sub>H</sub>										
Set Features	EF <sub>H</sub>										
Set Max Address	F9 <sub>H</sub>										
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	<table> <tr> <td>Address:</td><td>00<sub>H</sub></td></tr> <tr> <td>Password:</td><td>01<sub>H</sub></td></tr> <tr> <td>Lock:</td><td>02<sub>H</sub></td></tr> <tr> <td>Unlock:</td><td>03<sub>H</sub></td></tr> <tr> <td>Freeze Lock:</td><td>04<sub>H</sub></td></tr> </table>	Address:	00 <sub>H</sub>	Password:	01 <sub>H</sub>	Lock:	02 <sub>H</sub>	Unlock:	03 <sub>H</sub>	Freeze Lock:	04 <sub>H</sub>
Address:	00 <sub>H</sub>										
Password:	01 <sub>H</sub>										
Lock:	02 <sub>H</sub>										
Unlock:	03 <sub>H</sub>										
Freeze Lock:	04 <sub>H</sub>										
Set Max Address Extended	37 <sub>H</sub>										
Set Multiple Mode	C6 <sub>H</sub>										
Sleep	E6 <sub>H</sub>										
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>										
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>										
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>										
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>										
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>										
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>										
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>										
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>										
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>										
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>										
Standby	E2 <sub>H</sub>										
Standby Immediate	E0 <sub>H</sub>										
Write Buffer	E8 <sub>H</sub>										
Write DMA	CA <sub>H</sub>										
Write DMA Extended	35 <sub>H</sub>										
Write DMA FUA Extended	3D <sub>H</sub>										
Write DMA Without Retries	CB <sub>H</sub>										
Write Log Extended	3F <sub>H</sub>										
Write Multiple	C5 <sub>H</sub>										
Write Multiple Extended	39 <sub>H</sub>										
Write Multiple FUA Extended	CE <sub>H</sub>										
Write Sectors	30 <sub>H</sub>										
Write Sectors Without Retries	31 <sub>H</sub>										
Write Sectors Extended	34 <sub>H</sub>										
Write Uncorrectable	45 <sub>H</sub>										

### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 23. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>

Table 11 Identify Device commands (continued)

Word	Description	Value
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFF <sub>H</sub> (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFF <sub>H</sub> in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFF <sub>H</sub> *
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>

Table 11 Identify Device commands (continued)

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFh.	ST3000DM001 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.
	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.

	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 4.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 13 S.M.A.R.T. commands**

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.



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# Exhibit 10



Product Manual

## Seagate® Desktop HDD

Formerly Barracuda 7200.14

ST3000DM001

ST2000DM001

ST1500DM003

ST1000DM003

ST750DM003

ST500DM002

ST320DM000

ST250DM000

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Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)
Rev. J	05/08/2014	Updated product name (pages fc, 2, 19 & 22) and Add metric "mm" values to mechanical drawings. (pages 20-21).

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## 1.0 Introduction

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This manual describes the functional, mechanical and interface specifications for the following:  
Seagate® Desktop HDD model drives:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGM recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queueing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

## 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

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The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

---

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003
ST750DM003	ST500DM002	ST320DM000	ST250DM000

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1** Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models

Drive Specification*	ST3000DM001; ST2000DM001	ST1500DM003; ST1000DM003	ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in		146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical		
Startup current 12V	2.0A or 2.8A		2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		

Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)

Drive Specification*	ST3000DM001; ST2000DM001	ST2000DM001; ST1500DM003	ST1000DM003; ST750DM003
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)		
Altitude, operating	–304.8m to 3048m (–1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	–304.8m to 12,192m (–1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.4 bels (typical) 2.6 bels (max)		2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)		2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Rated workload	Average rate of <55TB/year. The AFR specification for the drive assumes the I/O workload does not exceed the average annualized workload rate limit of 55TB/year. Workloads exceeding the annualized rate may degrade the drive AFR and impact product reliability. The average annualized workload rate limit is in units of TB per year, or TB per 8760 power-on hours. Workload rate limit = TB transferred × (8760/recorded power-on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on “Check to see if the drive is under Warranty”. Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2		1
Disks	1		
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1413kb/in		
Track density (avg)	236ktracks/in		
Areal density (avg)	329Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	1695Mb/s		
Average Data Rate, read/write (MB/s)	125MB/s		
Maximum sustained data transfer rate, OD read	144MB/s		
I/O data-transfer rate (max.)	600MB/s		
Cache buffer	16MB		
Height (max)	19.98mm / 0.787 in		
Width (max)	101.6mm / 4.0 in (± 0.010 in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	415g / 0.915 lb		
Average latency	4.16ms		
Power-on to ready (max)	<8.5s		
Power-on to ready, 2.5A spin-up code option (typ)	n/a		
Standby to ready (max)	<8.5s		
Average seek, read (typical)	<8.5ms (read)		
Average seek, write (typical)	<9.5ms (write)		
Startup current (typical) 12V	2.0A		
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms		
Non-operational shock (max)	350 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.2 bels (typical) 2.3 bels (max)		
Seek	2.3 bels (typical) 2.4 bels (max)		
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Rated workload	Average rate of <5TB/year. The AFR specification for the drive assumes the I/O workload does not exceed the average annualized workload rate limit of 55TB/year. Workloads exceeding the annualized rate may degrade the drive AFR and impact product reliability. The average annualized workload rate limit is in units of TB per year, or TB per 8760 power-on hours. Workload rate limit = TB transferred × (8760/recorded power-on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> From this page, click on “Check to see if the drive is under Warranty”. Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001	3000GB	5,860,533,168	4K
ST2000DM001	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.



### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

### 2.3 Default logical geometry

- **Cylinders:** 16,383
- **Read/write heads:** 16
- **Sectors per track:** 63

#### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

### 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600



## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB, 750GB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in (± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

- Track-to-track seek time is an average of all possible single-track seeks in both directions.
- Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	3-disk (3TB, 2TB models)	2-disk (2TB, 1.5TB models)	1-disk (1TB, 750GB models)	1-disk (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 19**.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3, Table 4, Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

- Spinup power  
Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.
- Read/write power and current  
Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.
- Operating power and current  
Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.
- Idle mode power  
Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.
- Standby mode  
During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

*Table 3 DC power requirements (3-disk: 3TB and 2TB models)*

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

*Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)*

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

*Table 5 DC power requirements (1-disk: 1TB and 750GB models)*

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

*Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)*

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

- Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.
- Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

## 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

- 5V  $\pm 5\%$
- 12V  $+10\%$  /  $-7.5\%$

## 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

- **Active mode**  
The drive is in Active mode during the read/write and seek operations.
- **Idle mode**  
The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.
- **Standby mode**  
The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.
- **Sleep mode**  
The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.
- **Idle and Standby timers**  
Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.

Refer to **Section 3.4 on page 20** for base plate measurement location.

### 2.9.1 Ambient temperature

Operating	0° to 60°C (32° to 140°F)
Non-operating	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

Operating	20°C per hour (68°F per hour max), without condensation
Non-operating	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

Operating	5% to 95% non-condensing (30% per hour max)
Nonoperating	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

Operating	37.7°C (99.9°F max)
Non-operating	40°C (104°F max)

### 2.9.4 Altitude

Operating	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
Non-operating	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

	Maximum storage condition not to exceed 90 days at a wetbulb temperature of 32°C (example: 34°C / 90% RH)
--	-----------------------------------------------------------------------------------------------------------

## 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

### 2.9.5.2 Non-operating shock

#### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

#### 1TB, 750GB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

### 2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

## 2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

## 2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

	<p>For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:</p> $(\text{Number of seeks per second}) = 0.4 / (\text{average latency} + \text{average access time})$
--	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (2TB, 1.5TB)		
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

### 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in **Table 8**.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94



## 2.12 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:  
<http://www.seagate.com/support/warranty-and-replacements/>

From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.

## 2.13 Agency certification

### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

#### Korean RRL

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

- Family name: Barracuda
- Certificate number: KCC-REM-STX-Barracuda

#### Australian C-Tick (N176)

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).



### 2.13.3FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

### 2.14 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

#### 2.14.1European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

## 2.14.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

## 2.15 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

- Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.
- Handle the drive by its edges or frame *only*.
- The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.
- Always rest the drive on a padded, antistatic surface until mounting it in the computer.
- Do not touch the connector pins or the printed circuit board.
- Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

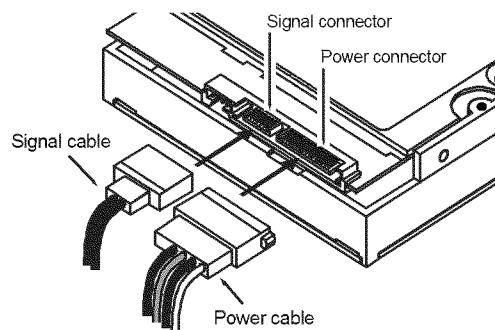
### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See **Table 9** for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in **Figure 1**.

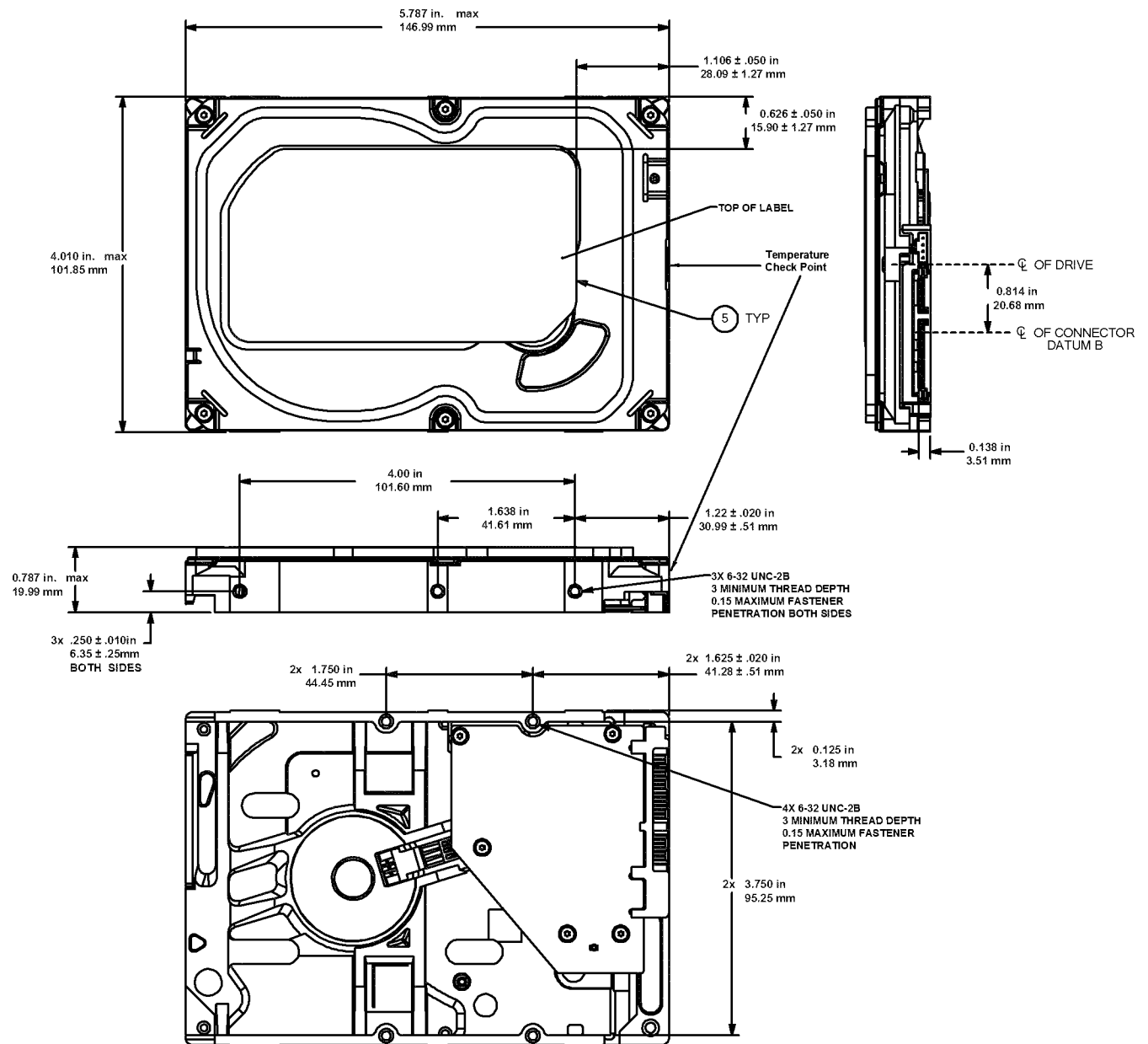
**Figure 1** Attaching SATA cabling



Each cable is keyed to ensure correct orientation. Desktop HDD drives support latching SATA connectors.



Figure 3 Mounting dimensions (1-disk: 250GB to 1TB models)



Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.

## 4.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 4.1 Hot-Plug compatibility

Desktop HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 4.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

*Table 9 SATA connector pin definitions*

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
<b>Key and spacing separate signal and power segments</b>			
Power	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

#### Notes

1. All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
2. The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
3. There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
  - All used voltage pins (V<sub>x</sub>) must be terminated.



### 4.3 Supported ATA commands

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 30 for details and subcommands used in the S.M.A.R.T. implementation.

*Table 10 SATA standard commands*

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>

Table 10 SATA standard commands (continued)

Command name	Command code (in hex)
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address	F9 <sub>H</sub>
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	<div>Address: 00<sub>H</sub></div> <div>Password: 01<sub>H</sub></div> <div>Lock: 02<sub>H</sub></div> <div>Unlock: 03<sub>H</sub></div> <div>Freeze Lock: 04<sub>H</sub></div>
Set Max Address Extended	37 <sub>H</sub>
Set Multiple Mode	C6 <sub>H</sub>
Sleep	E6 <sub>H</sub>
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>
Standby	E2 <sub>H</sub>
Standby Immediate	E0 <sub>H</sub>
Write Buffer	E8 <sub>H</sub>
Write DMA	CA <sub>H</sub>
Write DMA Extended	35 <sub>H</sub>
Write DMA FUA Extended	3D <sub>H</sub>
Write DMA Without Retries	CB <sub>H</sub>
Write Log Extended	3F <sub>H</sub>
Write Multiple	C5 <sub>H</sub>
Write Multiple Extended	39 <sub>H</sub>
Write Multiple FUA Extended	CE <sub>H</sub>
Write Sectors	30 <sub>H</sub>
Write Sectors Without Retries	31 <sub>H</sub>
Write Sectors Extended	34 <sub>H</sub>
Write Uncorrectable	45 <sub>H</sub>



### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 23. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: <ul style="list-style-type: none"> <li>• Bit 15: 0 = ATA; 1 = ATAPI</li> <li>• Bit 7: removable media</li> <li>• Bit 6: removable controller</li> <li>• Bit 0: reserved</li> </ul>	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>

Table 11 Identify Device commands (continued)

Word	Description	Value
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFF <sub>H</sub> (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFF <sub>H</sub> in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFF <sub>H</sub> *
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>

Table 11 Identify Device commands (continued)

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFh.	ST3000DM001 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.
	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.

	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12** *Set Features command*

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 4.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at:

<http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

Table 13 S.M.A.R.T. commands

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.

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# Exhibit 11



Product Manual

## Seagate<sup>®</sup> Desktop HDD

### Standard models

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

### Self-Encryption models

ST3000DM002  
ST2000DM002  
ST1000DM004

Gen 14  
100686584  
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August 2014

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Revision	Date	Description of Change
Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
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Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)
Rev. J	05/08/2014	Updated product name (pages fc, 2, 19 & 22) and Add metric "mm" values to mechanical drawings. (pages 20-21).
Rev. K	08/28/2014	Add SED models and SED Section 4.0 (pages: fc, 2, 4, 7, 22-23 & 29)

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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit [www.bis.doc.gov](http://www.bis.doc.gov)), and controlled for import

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For Seagate reseller portal, visit: <http://www.seagate.com/partners/my-spp-dashboard/>

## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following:  
Seagate® Desktop HDD model drives:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

Previous generations of Seagate Self-Encrypting Drive models were called Full Disk Encryption (FDE) models before a differentiation between drive-based encryption and other forms of encryption was necessary.

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queueing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

## 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.

- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.

- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).



The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in		146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical)	<8.5ms typical		
Average seek, write (typical)	<9.5ms typical		
Startup current 12V	2.0A or 2.8A		2.0A

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Voltage tolerance (including noise)	5V: $\pm 5\%$ 12V: $+10\%$ / $-7.5\%$		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.4 bels (typical) 2.6 bels (max)		2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)		2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per $10^{14}$ bits read		
Rated workload	Average rate of <55TB/year. The AFR specification for the drive assumes the I/O workload does not exceed the average annualized workload rate limit of 55TB/year. Workloads exceeding the annualized rate may degrade the drive AFR and impact product reliability. The average annualized workload rate limit is in units of TB per year, or TB per 8760 power-on hours. Workload rate limit = TB transferred $\times$ (8760/recorded power-on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2		1
Disks	1		
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1413kb/in		
Track density (avg)	236ktracks/in		
Areal density (avg)	329Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	1695Mb/s		
Average Data Rate, read/write (MB/s)	125MB/s		
Maximum sustained data transfer rate, OD read	144MB/s		
I/O data-transfer rate (max.)	600MB/s		
Cache buffer	16MB		
Height (max)	19.98mm / 0.787 in		
Width (max)	101.6mm / 4.0 in (± 0.010 in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	415g / 0.915 lb		
Average latency	4.16ms		
Power-on to ready (max)	<8.5s		
Power-on to ready, 2.5A spin-up code option (typ)	n/a		
Standby to ready (max)	<8.5s		
Average seek, read (typical)	<8.5ms (read)		
Average seek, write (typical)	<9.5ms (write)		
Startup current (typical) 12V	2.0A		
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms		
Non-operational shock (max)	350 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		



**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.2 bels (typical) 2.3 bels (max)		
Seek	2.3 bels (typical) 2.4 bels (max)		
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Rated workload	Average rate of <55TB/year. The AFR specification for the drive assumes the I/O workload does not exceed the average annualized workload rate limit of 55TB/year. Workloads exceeding the annualized rate may degrade the drive AFR and impact product reliability. The average annualized workload rate limit is in units of TB per year, or TB per 8760 power-on hours. Workload rate limit = TB transferred × (8760/recorded power-on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001 ST3000DM002	3000GB	5,860,533,168	4K
ST2000DM001 ST2000DM002	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003 ST1000DM004	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 5.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

### 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

#### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

### 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600



## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB, 750GB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in (± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	



These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	3-disk (3TB, 2TB models)	2-disk (2TB, 1.5TB models)	1-disk (1TB, 750GB models)	1-disk (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 19**.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3, Table 4, Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

## 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V  $\pm 5\%$

12V  $+10\%$  /  $-7.5\%$

## 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

### Active mode

The drive is in Active mode during the read/write and seek operations.

### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.

Refer to **Section 3.4 Drive mounting** for base plate measurement location.

### 2.9.1 Ambient temperature

Operating	0° to 60°C (32° to 140°F)
Non-operating	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

Operating	20°C per hour (68°F per hour max), without condensation
Non-operating	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

Operating	5% to 95% non-condensing (30% per hour max)
Nonoperating	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

Operating	37.7°C (99.9°F max)
Non-operating	40°C (104°F max)

### 2.9.4 Altitude

Operating	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
Non-operating	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

Maximum storage condition not to exceed 90 days at a wetbulb temperature of 32°C (example: 34°C / 90& RH)

## 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

### 2.9.5.2 Non-operating shock

#### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

#### 1TB, 750GB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

### 2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

## 2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs



## 2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

	For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:
	(Number of seeks per second = $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (2TB, 1.5TB)		
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

### 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in **Table 8**.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:  
<http://www.seagate.com/support/warranty-and-replacements/>

From this page, click on “Check to see if the drive is under Warranty”. Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.

## 2.13 Agency certification

### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

#### Korean RRL

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

#### Australian C-Tick (N176)

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).



### 2.13.3FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.

- Move the device to one side or the other of the radio or TV.

- Move the device farther away from the radio or TV.

- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

### 2.14 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

#### 2.14.1European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

**2.14.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令**

This product has an Environmental Protection Use Period (EUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

**2.15 Corrosive environment**

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until mounting it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

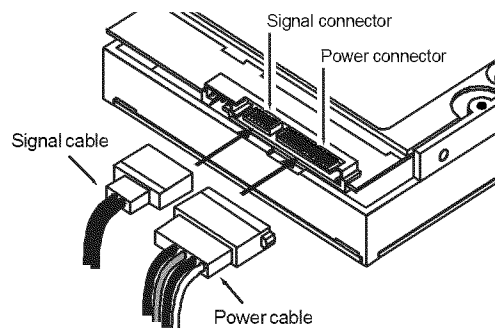
### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See **Table 9** for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in **Figure 1**.

**Figure 1** Attaching SATA cabling



Each cable is keyed to ensure correct orientation. Desktop HDD drives support latching SATA connectors.

### 3.4 Drive mounting

Users can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2** and **Figure 3** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

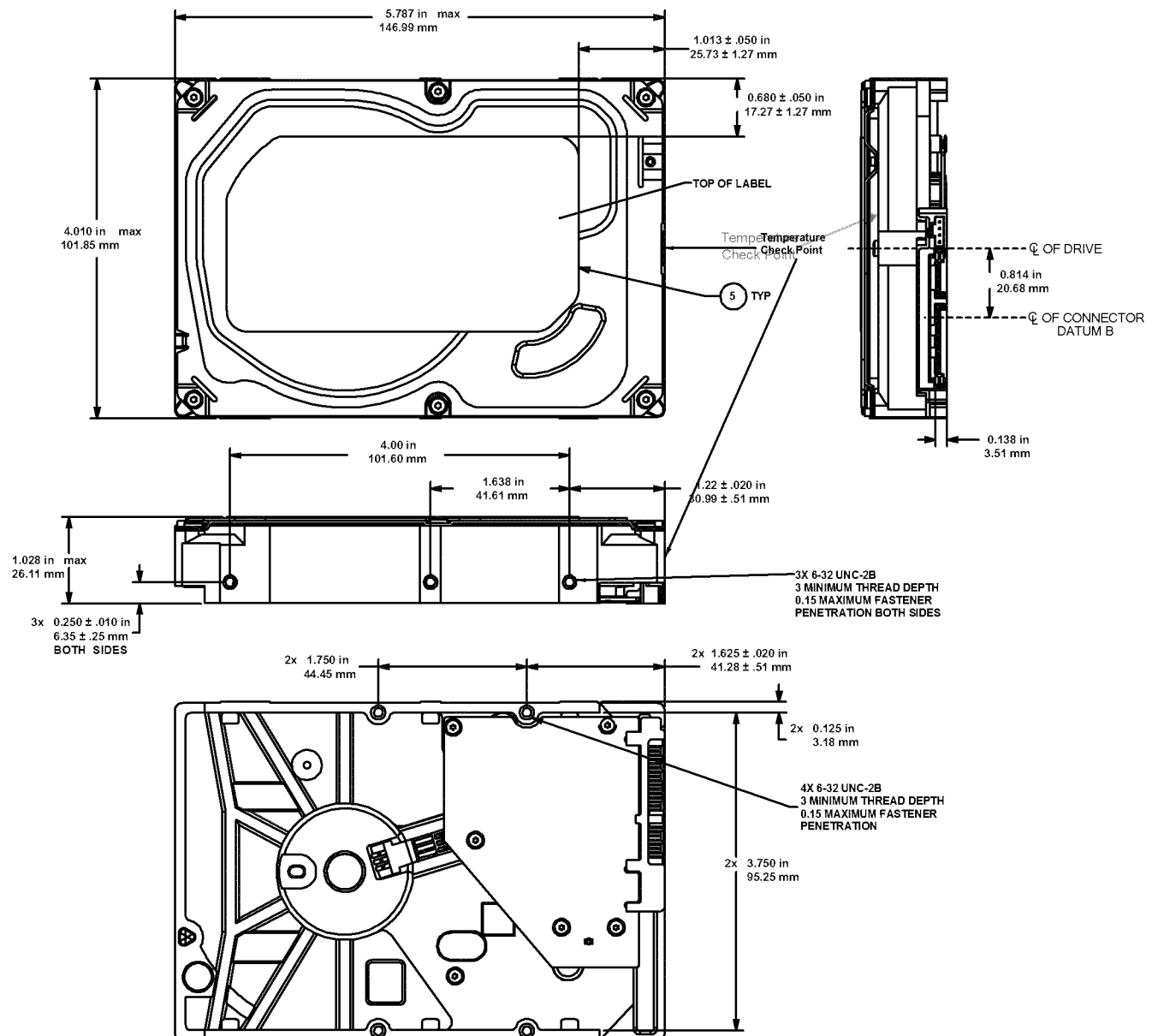
Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

Use only 6-32 UNC mounting screws.

The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.

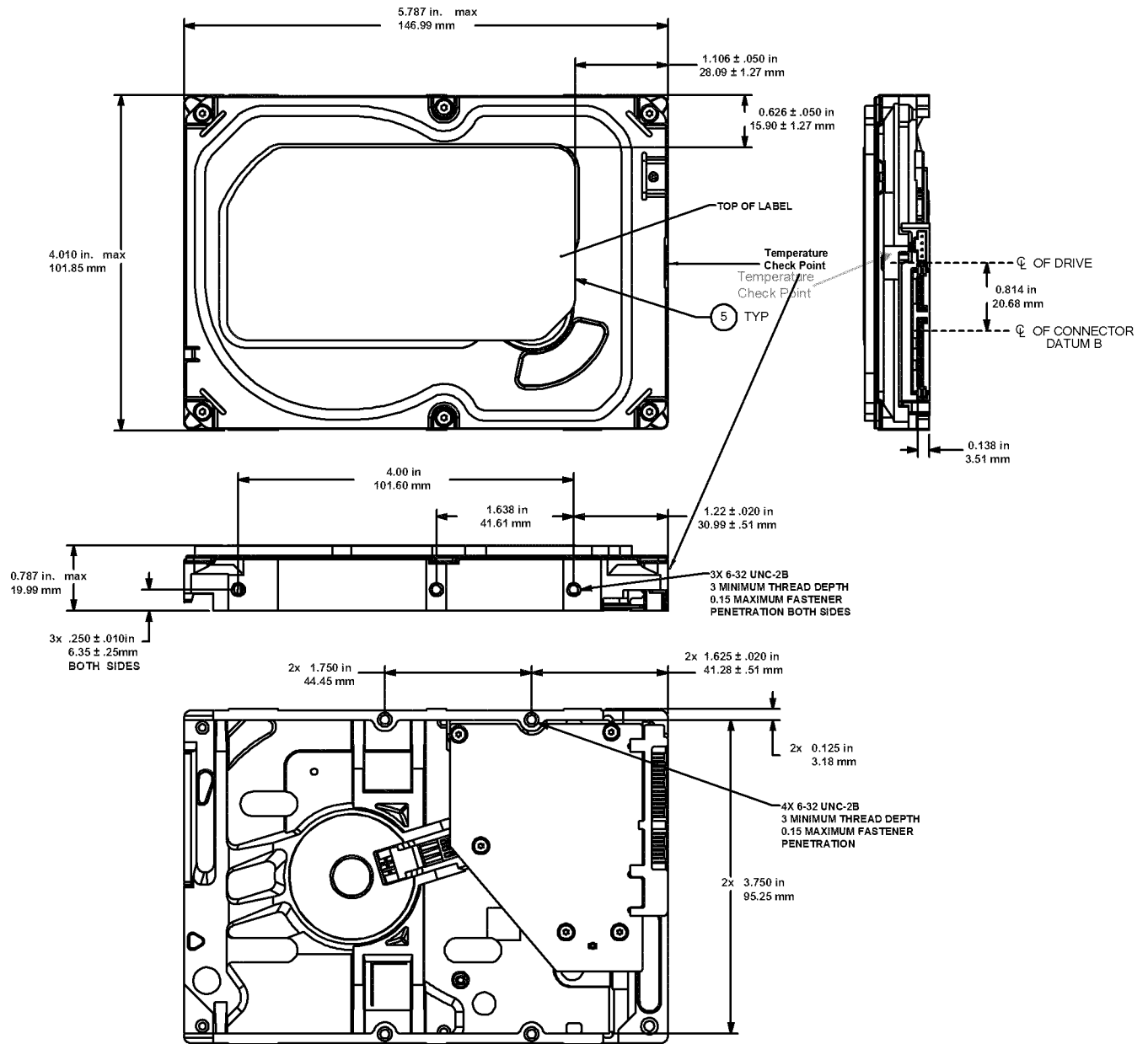
Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2 Mounting dimensions (3-disk: 1.5TB to 3TB models)**



Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.

Figure 3 Mounting dimensions (1-disk: 250GB to 1TB models)



Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.



## 4.0 About (SED) Self-Encrypting Drives

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Self-encrypting drives (SEDs) offer encryption and security services for the protection of stored data, commonly known as "protection of data at rest". These drives are compliant with the Trusted Computing Group (TCG) Opal Storage Specifications as detailed in the following:

Trusted Computing Group (TCG) Documents (apply to Self-Encrypting Drive models only)  
 TCG Storage Architecture Core Specification, Version 2.0  
 TCG Storage Security Subsystem Class Opal Specification, Version 2.0  
 (see [www.trustedcomputinggroup.org](http://www.trustedcomputinggroup.org))

In case of conflict between this document and any referenced document, this document takes precedence.

The Trusted Computing Group (TCG) is an organization sponsored and operated by companies in the computer, storage and digital communications industry. Seagate's SED models comply with the standards published by the TCG.

To use the security features in the drive, the host must be capable of constructing and issuing the following two SATA commands:

- Trusted Send
- Trusted Receive

These commands are used to convey the TCG protocol to and from the drive in their command payloads.

### 4.1 Data Encryption

Encrypting drives use one inline encryption engine for each drive employing AES-256 data encryption in Cipher Block Chaining (CBC) mode to encrypt all data prior to being written on the media and to decrypt all data as it is read from the media. The encryption engine is always in operation and cannot be disabled.

The 32-byte Data Encryption Key (DEK) is a random number which is generated by the drive, never leaves the drive, and is inaccessible to the host system. The DEK is itself encrypted when it is stored on the media and when it is in volatile temporary storage (DRAM) external to the encryption engine. A unique data encryption key is used for each of the drive's possible 16 data bands (see **Section 4.5 Data Bands**).

### 4.2 Controlled Access

The drive has two security providers (SPs) called the "Admin SP" and the "Locking SP." These act as gatekeepers to the drive security services. Security-related commands will not be accepted unless they also supply the correct credentials to prove the requester is authorized to perform the command.

#### 4.2.1 Admin SP

The Admin SP allows the drive's owner to enable or disable firmware download operations (see **Section 4.4 Drive Locking**). Access to the Admin SP is available using the SID (Secure ID) password or the MSID (Manufacturers Secure ID) password.

#### 4.2.2 Locking SP

The Locking SP controls read/write access to the media and the cryptographic erase feature. Access to the Locking SP is available using the Admin or User passwords.

#### 4.2.3 Default password

When the drive is shipped from the factory, all passwords are set to the value of MSID. This 32-byte random value can only be read by the host electronically over the interface. After receipt of the drive, it is the responsibility of the owner to use the default MSID password as the authority to change all other passwords to unique owner-specified values.

#### 4.2.4 ATA Enhanced Security

The drive can utilize the system's BIOS through the ATASecurity API for cases that do not require password management and additional security policies.

Furthermore, the drive's ATA Security Erase Unit command shall support both Normal and Enhanced Erase modes with the following modifications/additions:

**Normal Erase:** Normal erase feature shall be performed by changing the Data Encryption Key (DEK) of the drive, followed by an overwrite operation that repeatedly writes a single sector containing random data to the entire drive. This write operation bypasses the media encryption. On reading back the overwritten sectors, the host will receive a decrypted version, using the new DEK of the random data sector (the returned data will not match what was written).

**Enhanced Erase:** Enhanced erase shall be performed by changing the Data Encryption Key of the drive.

### 4.3 Random Number Generator (RNG)

The drive has a 32-byte hardware RNG that it uses to derive encryption keys or, if requested to do so, to provide random numbers to the host for system use, including using these numbers as Authentication Keys (passwords) for the drive's Admin and Locking SPs.

### 4.4 Drive Locking

In addition to changing the passwords, as described in **Section 4.2.3 Default password**, the owner should also set the data access controls for the individual bands.

The variable "LockOnReset" should be set to "PowerCycle" to ensure that the data bands will be locked if power is lost. In addition "ReadLockEnabled" and "WriteLockEnabled" must be set to true in the locking table in order for the bands "LockOnReset" setting of "PowerCycle" to actually lock access to the band when a "PowerCycle" event occurs. This scenario occurs if the drive is removed from its cabinet. The drive will not honor any data read or write requests until the bands have been unlocked. This prevents the user data from being accessed without the appropriate credentials when the drive has been removed from its cabinet and installed in another system.

### 4.5 Data Bands

When shipped from the factory, the drive is configured with a single data band called Band 0 (also known as the Global Data Band) which comprises LBA 0 through LBA max. The host may allocate additional bands (Band1 to Band15) by specifying a start LBA and an LBA range. The real estate for this band is taken from the Global Band.

Data bands cannot overlap but they can be sequential with one band ending at LBA (x) and the next beginning at LBA (x+1).

Each data band has its own drive-generated encryption key. The host may change the Encryption Key (see **Section 4.6 Cryptographic Erase**) or the password when required. The bands should be aligned to 4K LBA boundaries.

### 4.6 Cryptographic Erase

A significant feature of SEDs is the ability to perform a cryptographic erase. This involves the host telling the drive to change the data encryption key for a particular band. Once changed, the data is no longer recoverable since it was written with one key and will be read using a different key. Since the drive overwrites the old key with the new one, and keeps no history of key changes, the user data can never be recovered. This is tantamount to an instantaneous data erase and is very useful if the drive is to be scrapped or redispositioned.

### 4.7 Authenticated Firmware Download

In addition to providing a locking mechanism to prevent unwanted firmware download attempts, the drive also only accepts download files which have been cryptographically signed by the appropriate Seagate Design Center.

Three conditions must be met before the drive will allow the download operation:

1. The download must be an SED file. A standard (base) drive (non-SED) file will be rejected.
2. The download file must be signed and authenticated.
3. As with a non-SED drive, the download file must pass the acceptance criteria for the drive. For example it must be applicable to the correct drive model, and have compatible revision and customer status.

### 4.8 Power Requirements

The standard drive models and the SED drive models have identical hardware, however the security and encryption portion of the drive controller ASIC is enabled and functional in the SED models. This represents a small additional drain on the 5V supply of about

30mA and a commensurate increase of about 150mW in power consumption. There is no additional drain on the 12V supply. See the tables in **Section 2.8 Power specifications** for power requirements on the standard (non-SED) drive models.

### 4.9 Supported Commands

The SED models support the following two commands in addition to the commands supported by the standard (non-SED) models as listed in **Table 10**:

- Trusted Send
- Trusted Receive

### 4.10 RevertSP

SED models will support the RevertSP feature which erases all data in all bands on the device and returns the contents of all SPs (Security Providers) on the device to their original factory state. In order to execute the RevertSP method the unique PSID (Physical Secure ID) printed on the drive label must be provided. PSID is not electronically accessible and can only be manually read from the drive label or scanned in via the 2D barcode.

## 5.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 5.1 Hot-Plug compatibility

Desktop HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 5.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATA connector pin definitions

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			
Power	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

#### Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
  - All used voltage pins (V<sub>x</sub>) must be terminated.



### 5.3 Supported ATA commands

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 32 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 10 SATA standard commands**

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>

Table 10 SATA standard commands (continued)

Command name	Command code (in hex)	
Security Freeze	F5 <sub>H</sub>	
Security Set Password	F1 <sub>H</sub>	
Security Unlock	F2 <sub>H</sub>	
Seek	70 <sub>H</sub>	
Set Features	EF <sub>H</sub>	
Set Max Address	F9 <sub>H</sub>	
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Address:	00 <sub>H</sub>
	Password:	01 <sub>H</sub>
	Lock:	02 <sub>H</sub>
	Unlock:	03 <sub>H</sub>
	Freeze Lock:	04 <sub>H</sub>
Set Max Address Extended	37 <sub>H</sub>	
Set Multiple Mode	C6 <sub>H</sub>	
Sleep	E6 <sub>H</sub>	
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>	
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>	
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>	
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>	
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>	
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>	
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>	
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>	
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>	
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>	
Standby	E2 <sub>H</sub>	
Standby Immediate	E0 <sub>H</sub>	
Write Buffer	E8 <sub>H</sub>	
Write DMA	CA <sub>H</sub>	
Write DMA Extended	35 <sub>H</sub>	
Write DMA FUA Extended	3D <sub>H</sub>	
Write DMA Without Retries	CB <sub>H</sub>	
Write Log Extended	3F <sub>H</sub>	
Write Multiple	C5 <sub>H</sub>	
Write Multiple Extended	39 <sub>H</sub>	
Write Multiple FUA Extended	CE <sub>H</sub>	
Write Sectors	30 <sub>H</sub>	
Write Sectors Without Retries	31 <sub>H</sub>	
Write Sectors Extended	34 <sub>H</sub>	
Write Uncorrectable	45 <sub>H</sub>	

### 5.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 25. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>

Table 11 Identify Device commands (continued)

Word	Description	Value
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFF <sub>h</sub> (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFF <sub>h</sub> in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFF <sub>h</sub> *
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>

Table 11 Identify Device commands (continued)

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFh.	ST3000DM001 = 5,860,533,168 ST3000DM002 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST2000DM002 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST1000DM004 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.

	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 5.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.



### 5.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 13 S.M.A.R.T. commands**

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.



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# Exhibit 12



Product Manual

## Seagate<sup>®</sup> Desktop HDD

### Standard models

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

### Self-Encryption models

ST3000DM002  
ST2000DM002  
ST1000DM004

Gen 14  
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January 2015

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Revision	Date	Description of Change
Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)
Rev. J	05/08/2014	Updated product name (pages fc, 2, 19 & 22) and Add metric "mm" values to mechanical drawings. (pages 20-21).
Rev. K	08/28/2014	Add SED models and SED Section 4.0 (pages: fc, 2, 4, 7, 22-23 & 29)
Rev. L	01/26/2015	Applied new logo (pages: fc & bc), applied latest page numbering convention (pages: all), added AFR = <1.0% & update Rated Workload text (pages: 9 & 11), added Case Temp note & changed "&" to "%" in Storage note (page: 17), add Reliability Section 2.12 (page: 20), cleaned up text in Mechanical Drawings (pages: 24-25) & revised SED section 4.0 (pages: 26-27).

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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit [www.bis.doc.gov](http://www.bis.doc.gov)), and controlled for import

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For Seagate reseller portal, visit: <http://www.seagate.com/partners/my-spp-dashboard/>

## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following:  
Seagate® Desktop HDD model drives:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

Previous generations of Seagate Self-Encrypting Drive models were called Full Disk Encryption (FDE) models before a differentiation between drive-based encryption and other forms of encryption was necessary.

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queuing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

## 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.

- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.

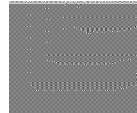
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).



The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in		146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical)	<8.5ms typical		
Average seek, write (typical)	<9.5ms typical		
Startup current 12V	2.0A or 2.8A		2.0A

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Voltage tolerance (including noise)	5V: $\pm 5\%$ 12V: $+10\%$ / $-7.5\%$		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power Idle***	2.4 bels (typical) 2.6 bels (max)		2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)		2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per $10^{14}$ bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Maximum Rated workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2		1
Disks	1		
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1413kb/in		
Track density (avg)	236ktracks/in		
Areal density (avg)	329Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	1695Mb/s		
Average Data Rate, read/write (MB/s)	125MB/s		
Maximum sustained data transfer rate, OD read	144MB/s		
I/O data-transfer rate (max.)	600MB/s		
Cache buffer	16MB		
Height (max)	19.98mm / 0.787 in		
Width (max)	101.6mm / 4.0 in (± 0.010 in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	415g / 0.915 lb		
Average latency	4.16ms		
Power-on to ready (max)	<8.5s		
Standby to ready (max)	<8.5s		
Average seek, read (typical)	<8.5ms (read)		
Average seek, write (typical)	<9.5ms (write)		
Startup current (typical) 12V	2.0A		
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms		
Non-operational shock (max)	350 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			



**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Idle***		2.2 bels (typical) 2.3 bels (max)	
Seek		2.3 bels (typical) 2.4 bels (max)	
Non-recoverable read errors		1 per 10 <sup>14</sup> bits read	
Annualized Failure Rate (AFR)		<1.0% based on 2400 POH	
Maximum Rated workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles		50,000 at 25°C, 50% rel. humidity	
Supports Hotplug operation per the Serial ATA Revision 3.2 specification		Yes	

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001 ST3000DM002	3000GB	5,860,533,168	4K
ST2000DM001 ST2000DM002	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003 ST1000DM004	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 5.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

### 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

#### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

### 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600

## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB, 750GB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in (± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

<b>Typical seek times (ms)</b>	<b>Read</b>	<b>Write</b>
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	



These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	3-disk (3TB, 2TB models)	2-disk (2TB, 1.5TB models)	1-disk (1TB, 750GB models)	1-disk (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 23**.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3, Table 4, Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

## 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V  $\pm 5\%$

12V  $+10\%$  /  $-7.5\%$

## 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

### Active mode

The drive is in Active mode during the read/write and seek operations.

### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.



The maximum allowable drive case temperature is 60°C.  
See Figures 2 & 3 for HDA case temperature measurement locations.

Refer to **Section 3.4 Drive mounting** for base plate measurement location.

### 2.9.1 Ambient temperature

Operating	0° to 60°C (32° to 140°F)
Non-operating	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

Operating	20°C per hour (68°F per hour max), without condensation
Non-operating	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

Operating	5% to 95% non-condensing (30% per hour max)
Nonoperating	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

Operating	37.7°C (99.9°F max)
Non-operating	40°C (104°F max)

### 2.9.4 Altitude

Operating	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
Non-operating	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)



Maximum storage condition not to exceed 90 days at a wetbulb temperature of 32°C (example: 34°C / 90% RH)



## 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

### 2.9.5.2 Non-operating shock

#### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

#### 1TB, 750GB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

### 2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

## 2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs



## 2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

	For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:
	(Number of seeks per second = $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (2TB, 1.5TB)		
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

### 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in **Table 8**.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Reliability

### 2.12.1 Annualized Failure Rate (AFR)

The production disk drive shall achieve an annualized failure-rate of <1.0% over a 5 year service life when used in Desktop Storage field conditions as limited by the following:

- 2400 power-on-hours per year.
- Typical workload

Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read, max
Maximum Rated Workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on the "Check to see if the drive is under Warranty" link. The following are required to be provided: the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.
Preventive maintenance	None required.

## 2.13 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page: <http://www.seagate.com/support/warranty-and-replacements/>

From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.

## 2.14 Agency certification

### 2.14.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.14.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

**Korean RRL**

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

**Australian C-Tick (N176)**

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

**2.14.3FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

Reorient the receiving antenna.

Move the device to one side or the other of the radio or TV.

Move the device farther away from the radio or TV.

Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

## 2.15 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

### 2.15.1 European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

### 2.15.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

## 2.16 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.



## 3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until mounting it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

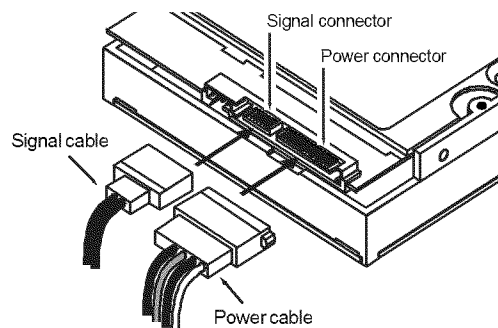
### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See **Table 9** for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in **Figure 1**.

**Figure 1** Attaching SATA cabling



Each cable is keyed to ensure correct orientation. Desktop HDD drives support latching SATA connectors.

### 3.4 Drive mounting

Users can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2** and **Figure 3** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

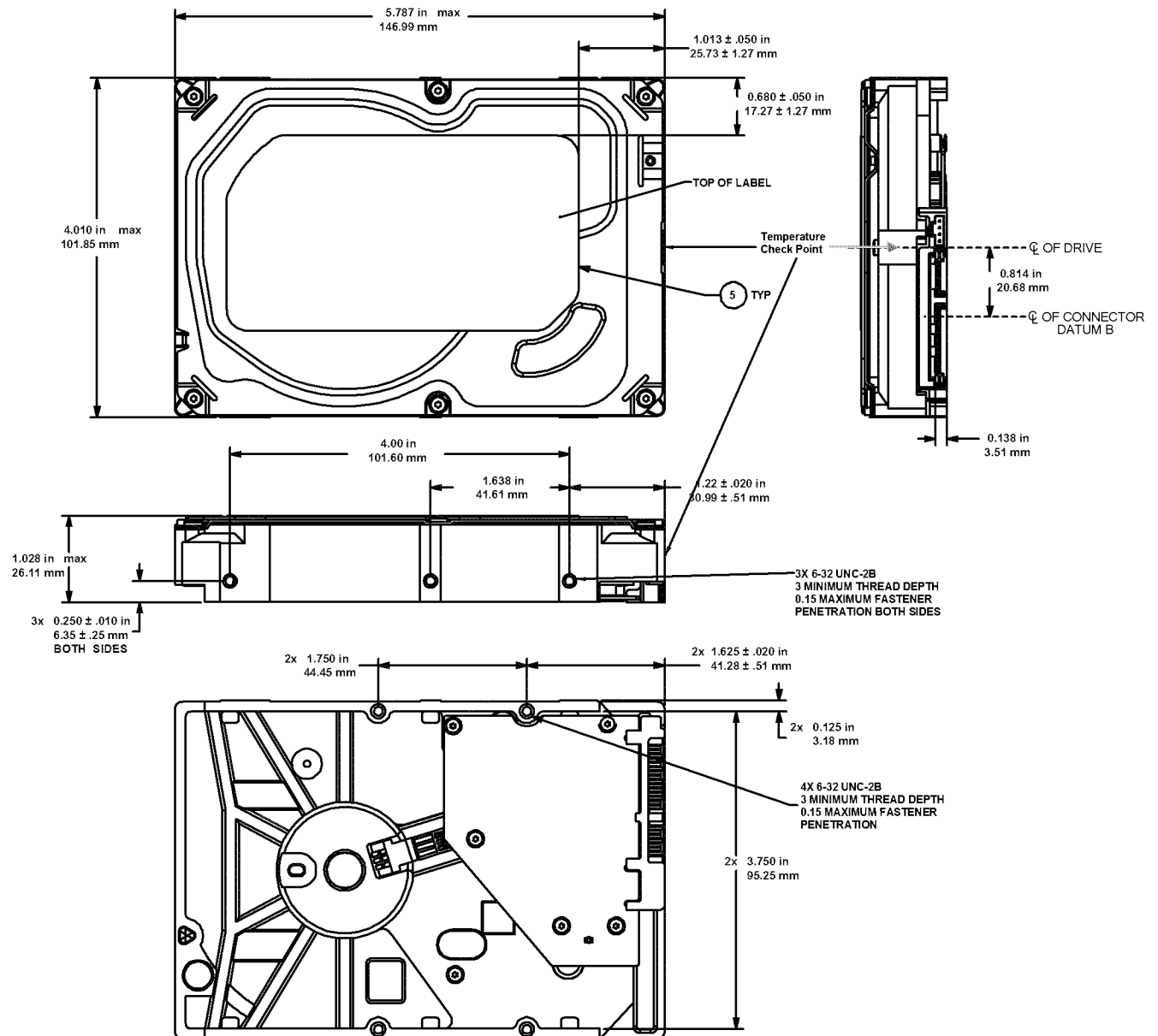
Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

Use only 6-32 UNC mounting screws.

The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.

Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2 Mounting dimensions (3-disk: 1.5TB to 3TB models)**



Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.

Technical drawing of a 3.5-inch floppy diskette showing top, side, and bottom views with dimensions in inches and millimeters.

**Top View Dimensions:**

- Overall width: 5.787 in. max (146.99 mm)
- Overall height: 4.010 in. max (101.85 mm)
- Inner width: 1.106 ± .050 in (28.09 ± 1.27 mm)
- Inner height: 0.626 ± .050 in (15.90 ± 1.27 mm)
- Label area: TOP OF LABEL
- Temperature Check Point
- Feature 5: 5 TYP

**Side View Dimensions:**

- Overall thickness: 0.787 in. max (19.99 mm)
- Inner thickness: 0.138 in (3.51 mm)
- Distance from top to drive: 0.814 in (20.68 mm)
- Distance from top to connector datum B: 0.138 in (3.51 mm)

**Bottom View Dimensions:**

- Overall width: 5.787 in. max (146.99 mm)
- Overall height: 4.010 in. max (101.85 mm)
- Inner width: 1.106 ± .050 in (28.09 ± 1.27 mm)
- Inner height: 0.626 ± .050 in (15.90 ± 1.27 mm)
- Label area: TOP OF LABEL
- Temperature Check Point
- Feature 5: 5 TYP

**Fastener Specifications:**

- 3X 6-32 UNC-2B 3 MINIMUM THREAD DEPTH 0.15 MAXIMUM FASTENER PENETRATION BOTH SIDES
- 4X 6-32 UNC-2B 3 MINIMUM THREAD DEPTH 0.15 MAXIMUM FASTENER PENETRATION

FED SEAG0070914

## 4.0 About (SED) Self-Encrypting Drives

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Self-encrypting drives (SEDs) offer encryption and security services for the protection of stored data, commonly known as "data at rest". These drives are compliant with the Trusted Computing Group (TCG) Opal Storage Specifications as detailed in the following:

TCG Storage Architecture Core Specification, Version 2.0 (see [www.trustedcomputinggroup.org](http://www.trustedcomputinggroup.org))

TCG Storage Security Subsystem Class Opal Specification, Version 2.0 (see [www.trustedcomputinggroup.org](http://www.trustedcomputinggroup.org))

In case of conflict between this document and any referenced document, this document takes precedence.

The Trusted Computing Group (TCG) is a standards organization sponsored and operated by companies in the computer, storage and digital communications industry. Seagate's SED models comply with the standards published by the TCG.

To use the security features in the drive, the host must be capable of constructing and issuing the following two SATA commands:

Trusted Send

Trusted Receive

These commands are used to convey the TCG protocol to and from the drive in their command payloads. Seagate Secure SEDs also support TCG Single User Mode, which can be disabled.

### 4.1 Data Encryption

Encrypting drives use one inline encryption engine within each drive employing AES-256 algorithms in Cipher Block Chaining (CBC) mode to encrypt all data prior to being written on the media and to decrypt all data as it is read from the media. The encryption engine is always in operation and cannot be disabled. The 32-byte Data Encryption Key (DEK) is a random number which is generated by the drive, never leaves the drive, and is inaccessible to the host system. The DEK is itself encrypted when it is stored on the media and when in volatile temporary storage (DRAM), which is external to the encryption engine. A unique data encryption key is used for each of the drive's possible 16 data bands (see **Section 4.5 Data Bands**).

### 4.2 Controlled Access

The drive has two security providers (SPs) called the "Admin SP" and the "Locking SP." These act as gatekeepers to the drive security services. Security-related commands will not be accepted unless the user provides the correct credentials to prove that they are authorized to perform the command.

#### 4.2.1 Admin SP

The Admin SP allows the drive's owner to enable or disable firmware download operations (see **Section 4.4 Drive Locking**). Access to the Admin SP is available using the SID (Secure ID) password.

#### 4.2.2 Locking SP

The Locking SP controls read/write access to the media and the cryptographic erase feature. Access to the Locking SP is available using the Admin or User passwords.

#### 4.2.3 Default password

When the drive is shipped from the factory, all passwords are set to the value of MSID. This 32-byte random value can only be read by the host electronically over the interface. After receipt of the drive, it is the responsibility of the owner to use the default MSID password as the authority to change all other passwords to unique owner-specified values.

#### 4.2.4 ATA Enhanced Security

The drive can utilize the system's BIOS through the ATA Security API for cases that do not require password management and additional security policies.

Furthermore, the drive's ATA Security Erase Unit command shall support both Normal and Enhanced Erase modes with the following modifications/additions:

**Normal Erase:** Normal erase feature shall be performed by changing the Data Encryption Key (DEK) of the drive, followed by an overwrite operation that repeatedly writes a single sector containing random data to the entire drive. This write operation bypasses the media encryption. On reading back the overwritten sectors, the host will receive a decrypted version, using the new DEK of the random data sector (the returned data will not match what was written).

**Enhanced Erase:** Enhanced erase shall be performed by changing the Data Encryption Key of the drive.



### 4.3 Random Number Generator (RNG)

The drive has a 32-byte hardware RNG that it uses to derive encryption keys or, if requested to do so, to provide random numbers to the host for system use, including using these numbers as Authentication Keys (passwords) for the drive's Admin and Locking SPs.

### 4.4 Drive Locking

In addition to changing the passwords, as described in **Section 4.2.3 Default password**, the owner should also set the data access controls for the individual bands.

The variable "LockOnReset" should be set to "PowerCycle" to ensure that the data bands will be locked if power is lost. In addition "ReadLockEnabled" and "WriteLockEnabled" must be set to true in the locking table in order for the bands "LockOnReset" setting of "PowerCycle" to actually lock access to the band when a "PowerCycle" event occurs. This scenario occurs if the drive is removed from its cabinet. The drive will not honor any data read or write requests until the bands have been unlocked. This prevents the user data from being accessed without the appropriate credentials when the drive has been removed from its cabinet and installed in another system.

### 4.5 Data Bands

When shipped from the factory, the drive is configured with a single data band called Band 0 (also known as the Global Data Band) which comprises LBA 0 through LBA max. The host may allocate additional bands (Band1 to Band15) by specifying a start LBA and an LBA range. The real estate for this band is taken from the Global Band.

Data bands cannot overlap but they can be sequential with one band ending at LBA (x) and the next beginning at LBA (x+1).

Each data band has its own drive-generated encryption key. The host may change the Encryption Key (see **Section 4.6 Cryptographic Erase**) or the password when required.

### 4.6 Cryptographic Erase

A valuable feature of SEDs is the ability to perform a cryptographic erase. This involves the host telling the drive to change the data encryption key for a particular band. Once changed, the data is no longer recoverable since it was written with one key and will be read using a different key. Since the drive overwrites the old key with the new one, and keeps no history of key the older key, the user data can never be recovered. This is done in a matter of seconds and is very useful if the drive is to be scrapped or repurposed.

### 4.7 Authenticated Firmware Download

In addition to providing a locking mechanism to prevent unwanted firmware download attempts, the drive also only accepts download files which have been cryptographically signed by the appropriate Seagate Design Center.

Three conditions must be met before the drive will allow the download operation:

1. The download must be an SED file. A standard drive (non-SED) file will be rejected.
2. The download file must be signed and authenticated.
3. As with a non-SED drive, the download file must pass the acceptance criteria for the drive. For example it must be applicable to the correct drive model, and have compatible revision and customer status.

### 4.8 Power Requirements

The standard drive models and the SED drive models have identical hardware, however the security and encryption portion of the drive controller ASIC is enabled and functional in the SED models. This represents a small additional drain on the 5V supply of about

30mA and a commensurate increase of about 150mW in power consumption. There is no additional drain on the 12V supply. See the tables in **Section 2.8 Power specifications** for power requirements on the standard (non-SED) drive models.

### 4.9 Supported Commands

The SED models support the following two commands in addition to the commands supported by the standard (non-SED) models as listed in **Table 10**:

Trusted Send  
Trusted Receive

### 4.10 RevertSP

SED models will support the RevertSP feature which erases all data in all bands on the device and returns the contents of all SPs (Security Providers) on the device to their original factory state. In order to execute the RevertSP method the unique PSID (Physical Secure ID) printed on the drive label must be provided. PSID is not electronically accessible and can only be manually read from the drive label or scanned in via the 2D barcode.

## 5.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 5.1 Hot-Plug compatibility

Desktop HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 5.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATA connector pin definitions

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			
Power	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

#### Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
  - All used voltage pins (V<sub>x</sub>) must be terminated.

### 5.3 Supported ATA commands

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 36 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 10 SATA standard commands**

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>

Table 10 SATA standard commands (continued)

Command name	Command code (in hex)	
Security Freeze	F5 <sub>H</sub>	
Security Set Password	F1 <sub>H</sub>	
Security Unlock	F2 <sub>H</sub>	
Seek	70 <sub>H</sub>	
Set Features	EF <sub>H</sub>	
Set Max Address	F9 <sub>H</sub>	
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Address:	00 <sub>H</sub>
	Password:	01 <sub>H</sub>
	Lock:	02 <sub>H</sub>
	Unlock:	03 <sub>H</sub>
	Freeze Lock:	04 <sub>H</sub>
Set Max Address Extended	37 <sub>H</sub>	
Set Multiple Mode	C6 <sub>H</sub>	
Sleep	E6 <sub>H</sub>	
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>	
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>	
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>	
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>	
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>	
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>	
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>	
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>	
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>	
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>	
Standby	E2 <sub>H</sub>	
Standby Immediate	E0 <sub>H</sub>	
Write Buffer	E8 <sub>H</sub>	
Write DMA	CA <sub>H</sub>	
Write DMA Extended	35 <sub>H</sub>	
Write DMA FUA Extended	3D <sub>H</sub>	
Write DMA Without Retries	CB <sub>H</sub>	
Write Log Extended	3F <sub>H</sub>	
Write Multiple	C5 <sub>H</sub>	
Write Multiple Extended	39 <sub>H</sub>	
Write Multiple FUA Extended	CE <sub>H</sub>	
Write Sectors	30 <sub>H</sub>	
Write Sectors Without Retries	31 <sub>H</sub>	
Write Sectors Extended	34 <sub>H</sub>	
Write Uncorrectable	45 <sub>H</sub>	

### 5.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 29. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>



Table 11 Identify Device commands (continued)

Word	Description	Value
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFF <sub>H</sub> (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFF <sub>H</sub> in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFF <sub>H</sub> *
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>

Table 11 Identify Device commands (continued)

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFH.	ST3000DM001 = 5,860,533,168 ST3000DM002 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST2000DM002 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST1000DM004 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.

	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.



### 5.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 5.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 13 S.M.A.R.T. commands**

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.



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January 2015

## Exhibit 13



Product Manual

## Seagate<sup>®</sup> Desktop HDD

### Standard models

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

### Self-Encryption models

ST3000DM002  
ST2000DM002  
ST1000DM004

Gen 14  
100686584  
Rev. M  
March 2015

**Document Revision History**

Revision	Date	Description of Change
Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)
Rev. J	05/08/2014	Updated product name (pages fc, 2, 19 & 22) and Add metric "mm" values to mechanical drawings. (pages 20-21).
Rev. K	08/28/2014	Add SED models and SED Section 4.0 (pages: fc, 2, 4, 7, 22-23 & 29)
Rev. L	01/26/2015	Applied new logo (pages: fc & bc), applied latest page numbering convention (pages: all), added AFR = <1.0% & update Rated Workload text (pages: 9 & 11), added Case Temp note & changed "&" to "%" in Storage note (page: 17), add Reliability Section 2.12 (page: 20), cleaned up text in Mechanical Drawings (pages: 24-25) & revised SED section 4.0 (pages: 26-27).
Rev. M	03/10/2015	Change Max Case Temperature to 69°C (page: 17)

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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit [www.bis.doc.gov](http://www.bis.doc.gov)), and controlled for import

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For Seagate OEM and Distribution partner portal, visit: <http://www.seagate.com/partners>

For Seagate reseller portal, visit: <http://www.seagate.com/partners/my-spp-dashboard/>

## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following:  
Seagate® Desktop HDD model drives:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

Previous generations of Seagate Self-Encrypting Drive models were called Full Disk Encryption (FDE) models before a differentiation between drive-based encryption and other forms of encryption was necessary.

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queuing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

## 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.

- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.

- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).



The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in		146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical)	<8.5ms typical		
Average seek, write (typical)	<9.5ms typical		
Startup current 12V	2.0A or 2.8A		2.0A

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power Idle***	2.4 bels (typical) 2.6 bels (max)		2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)		2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Maximum Rated workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2		1
Disks	1		
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1413kb/in		
Track density (avg)	236ktracks/in		
Areal density (avg)	329Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	1695Mb/s		
Average Data Rate, read/write (MB/s)	125MB/s		
Maximum sustained data transfer rate, OD read	144MB/s		
I/O data-transfer rate (max.)	600MB/s		
Cache buffer	16MB		
Height (max)	19.98mm / 0.787 in		
Width (max)	101.6mm / 4.0 in (± 0.010 in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	415g / 0.915 lb		
Average latency	4.16ms		
Power-on to ready (max)	<8.5s		
Standby to ready (max)	<8.5s		
Average seek, read (typical)	<8.5ms (read)		
Average seek, write (typical)	<9.5ms (write)		
Startup current (typical) 12V	2.0A		
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms		
Non-operational shock (max)	350 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			



**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Idle***		2.2 bels (typical) 2.3 bels (max)	
Seek		2.3 bels (typical) 2.4 bels (max)	
Non-recoverable read errors		1 per 10 <sup>14</sup> bits read	
Annualized Failure Rate (AFR)		<1.0% based on 2400 POH	
Maximum Rated workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles		50,000 at 25°C, 50% rel. humidity	
Supports Hotplug operation per the Serial ATA Revision 3.2 specification		Yes	

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001 ST3000DM002	3000GB	5,860,533,168	4K
ST2000DM001 ST2000DM002	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003 ST1000DM004	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.



### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 5.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

### 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

#### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

### 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600

## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB, 750GB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in (± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

<b>Typical seek times (ms)</b>	<b>Read</b>	<b>Write</b>
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	



These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	3-disk (3TB, 2TB models)	2-disk (2TB, 1.5TB models)	1-disk (1TB, 750GB models)	1-disk (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 23**.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3, Table 4, Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

---

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

---

## 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V  $\pm 5\%$

12V  $+10\%$  /  $-7.5\%$

## 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

### Active mode

The drive is in Active mode during the read/write and seek operations.

### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.



The maximum allowable drive case temperature is 69°C.  
See Figures 2 & 3 for HDA case temperature measurement locations.

Refer to **Section 3.4 Drive mounting** for base plate measurement location.

### 2.9.1 Ambient temperature

Operating	0° to 60°C (32° to 140°F)
Non-operating	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

Operating	20°C per hour (68°F per hour max), without condensation
Non-operating	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

Operating	5% to 95% non-condensing (30% per hour max)
Nonoperating	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

Operating	37.7°C (99.9°F max)
Non-operating	40°C (104°F max)

### 2.9.4 Altitude

Operating	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
Non-operating	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)



Maximum storage condition not to exceed 90 days at a wetbulb temperature of 32°C (example: 34°C / 90% RH)

## 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

### 2.9.5.2 Non-operating shock

#### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

#### 1TB, 750GB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

### 2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

## 2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs



## 2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

	For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:
	(Number of seeks per second = $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (2TB, 1.5TB)		
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

### 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in **Table 8**.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94



## 2.12 Reliability

### 2.12.1 Annualized Failure Rate (AFR)

The production disk drive shall achieve an annualized failure-rate of <1.0% over a 5 year service life when used in Desktop Storage field conditions as limited by the following:

- 2400 power-on-hours per year.
- Typical workload

Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read, max
Maximum Rated Workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on the "Check to see if the drive is under Warranty" link. The following are required to be provided: the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.
Preventive maintenance	None required.

## 2.13 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page: <http://www.seagate.com/support/warranty-and-replacements/>

From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.

## 2.14 Agency certification

### 2.14.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.14.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

**Korean RRL**

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

**Australian C-Tick (N176)**

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

**2.14.3FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

Reorient the receiving antenna.

Move the device to one side or the other of the radio or TV.

Move the device farther away from the radio or TV.

Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

## 2.15 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

### 2.15.1 European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

### 2.15.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

## 2.16 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until mounting it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

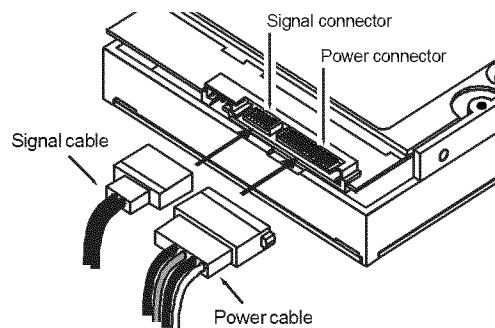
### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See **Table 9** for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in **Figure 1**.

**Figure 1** Attaching SATA cabling



Each cable is keyed to ensure correct orientation. Desktop HDD drives support latching SATA connectors.

### 3.4 Drive mounting

Users can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2** and **Figure 3** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

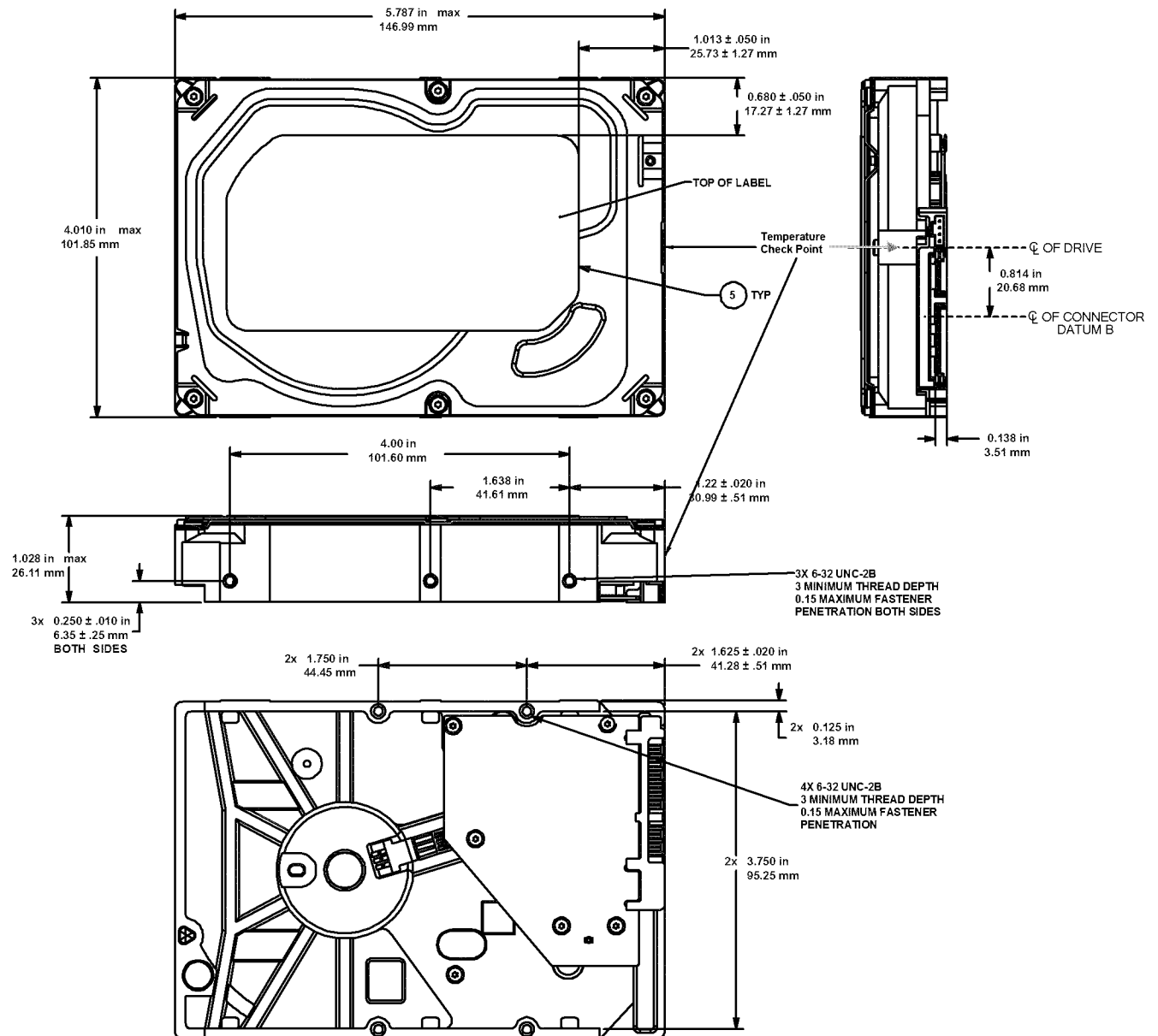
Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

Use only 6-32 UNC mounting screws.

The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.

Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

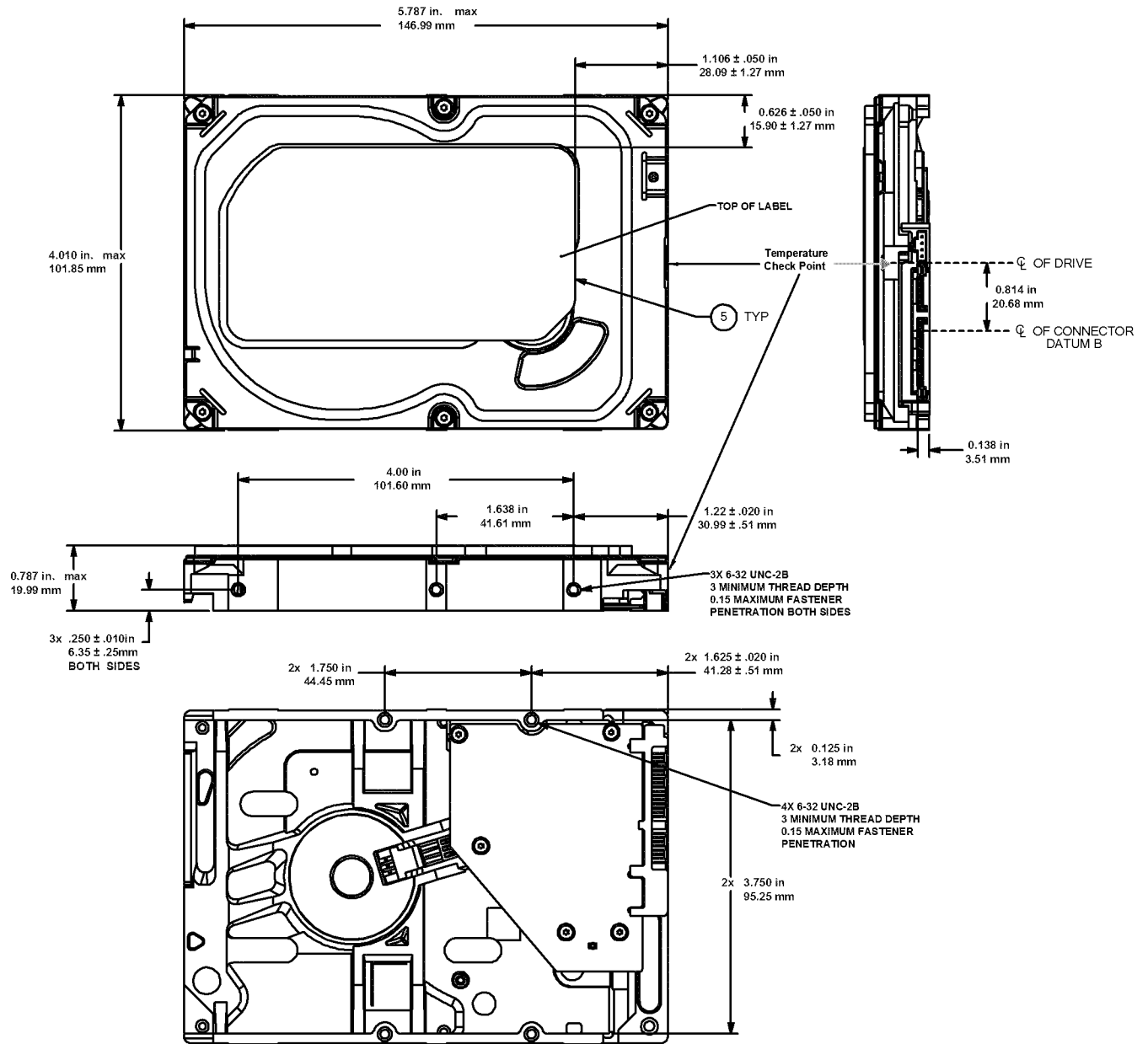
**Figure 2 Mounting dimensions (3-disk: 1.5TB to 3TB models)**



Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.



Figure 3 Mounting dimensions (1-disk: 250GB to 1TB models)



Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.

## 4.0 About (SED) Self-Encrypting Drives

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Self-encrypting drives (SEDs) offer encryption and security services for the protection of stored data, commonly known as "data at rest". These drives are compliant with the Trusted Computing Group (TCG) Opal Storage Specifications as detailed in the following:

TCG Storage Architecture Core Specification, Version 2.0 (see [www.trustedcomputinggroup.org](http://www.trustedcomputinggroup.org))

TCG Storage Security Subsystem Class Opal Specification, Version 2.0 (see [www.trustedcomputinggroup.org](http://www.trustedcomputinggroup.org))

In case of conflict between this document and any referenced document, this document takes precedence.

The Trusted Computing Group (TCG) is a standards organization sponsored and operated by companies in the computer, storage and digital communications industry. Seagate's SED models comply with the standards published by the TCG.

To use the security features in the drive, the host must be capable of constructing and issuing the following two SATA commands:

Trusted Send

Trusted Receive

These commands are used to convey the TCG protocol to and from the drive in their command payloads. Seagate Secure SEDs also support TCG Single User Mode, which can be disabled.

### 4.1 Data Encryption

Encrypting drives use one inline encryption engine within each drive employing AES-256 algorithms in Cipher Block Chaining (CBC) mode to encrypt all data prior to being written on the media and to decrypt all data as it is read from the media. The encryption engine is always in operation and cannot be disabled. The 32-byte Data Encryption Key (DEK) is a random number which is generated by the drive, never leaves the drive, and is inaccessible to the host system. The DEK is itself encrypted when it is stored on the media and when in volatile temporary storage (DRAM), which is external to the encryption engine. A unique data encryption key is used for each of the drive's possible 16 data bands (see **Section 4.5 Data Bands**).

### 4.2 Controlled Access

The drive has two security providers (SPs) called the "Admin SP" and the "Locking SP." These act as gatekeepers to the drive security services. Security-related commands will not be accepted unless the user provides the correct credentials to prove that they are authorized to perform the command.

#### 4.2.1 Admin SP

The Admin SP allows the drive's owner to enable or disable firmware download operations (see **Section 4.4 Drive Locking**). Access to the Admin SP is available using the SID (Secure ID) password.

#### 4.2.2 Locking SP

The Locking SP controls read/write access to the media and the cryptographic erase feature. Access to the Locking SP is available using the Admin or User passwords.

#### 4.2.3 Default password

When the drive is shipped from the factory, all passwords are set to the value of MSID. This 32-byte random value can only be read by the host electronically over the interface. After receipt of the drive, it is the responsibility of the owner to use the default MSID password as the authority to change all other passwords to unique owner-specified values.

#### 4.2.4 ATA Enhanced Security

The drive can utilize the system's BIOS through the ATA Security API for cases that do not require password management and additional security policies.

Furthermore, the drive's ATA Security Erase Unit command shall support both Normal and Enhanced Erase modes with the following modifications/additions:

**Normal Erase:** Normal erase feature shall be performed by changing the Data Encryption Key (DEK) of the drive, followed by an overwrite operation that repeatedly writes a single sector containing random data to the entire drive. This write operation bypasses the media encryption. On reading back the overwritten sectors, the host will receive a decrypted version, using the new DEK of the random data sector (the returned data will not match what was written).

**Enhanced Erase:** Enhanced erase shall be performed by changing the Data Encryption Key of the drive.

### 4.3 Random Number Generator (RNG)

The drive has a 32-byte hardware RNG that it uses to derive encryption keys or, if requested to do so, to provide random numbers to the host for system use, including using these numbers as Authentication Keys (passwords) for the drive's Admin and Locking SPs.

### 4.4 Drive Locking

In addition to changing the passwords, as described in **Section 4.2.3 Default password**, the owner should also set the data access controls for the individual bands.

The variable "LockOnReset" should be set to "PowerCycle" to ensure that the data bands will be locked if power is lost. In addition "ReadLockEnabled" and "WriteLockEnabled" must be set to true in the locking table in order for the bands "LockOnReset" setting of "PowerCycle" to actually lock access to the band when a "PowerCycle" event occurs. This scenario occurs if the drive is removed from its cabinet. The drive will not honor any data read or write requests until the bands have been unlocked. This prevents the user data from being accessed without the appropriate credentials when the drive has been removed from its cabinet and installed in another system.

### 4.5 Data Bands

When shipped from the factory, the drive is configured with a single data band called Band 0 (also known as the Global Data Band) which comprises LBA 0 through LBA max. The host may allocate additional bands (Band1 to Band15) by specifying a start LBA and an LBA range. The real estate for this band is taken from the Global Band.

Data bands cannot overlap but they can be sequential with one band ending at LBA (x) and the next beginning at LBA (x+1).

Each data band has its own drive-generated encryption key. The host may change the Encryption Key (see **Section 4.6 Cryptographic Erase**) or the password when required.

### 4.6 Cryptographic Erase

A valuable feature of SEDs is the ability to perform a cryptographic erase. This involves the host telling the drive to change the data encryption key for a particular band. Once changed, the data is no longer recoverable since it was written with one key and will be read using a different key. Since the drive overwrites the old key with the new one, and keeps no history of key the older key, the user data can never be recovered. This is done in a matter of seconds and is very useful if the drive is to be scrapped or repurposed.

### 4.7 Authenticated Firmware Download

In addition to providing a locking mechanism to prevent unwanted firmware download attempts, the drive also only accepts download files which have been cryptographically signed by the appropriate Seagate Design Center.

Three conditions must be met before the drive will allow the download operation:

1. The download must be an SED file. A standard drive (non-SED) file will be rejected.
2. The download file must be signed and authenticated.
3. As with a non-SED drive, the download file must pass the acceptance criteria for the drive. For example it must be applicable to the correct drive model, and have compatible revision and customer status.

### 4.8 Power Requirements

The standard drive models and the SED drive models have identical hardware, however the security and encryption portion of the drive controller ASIC is enabled and functional in the SED models. This represents a small additional drain on the 5V supply of about

30mA and a commensurate increase of about 150mW in power consumption. There is no additional drain on the 12V supply. See the tables in **Section 2.8 Power specifications** for power requirements on the standard (non-SED) drive models.

### 4.9 Supported Commands

The SED models support the following two commands in addition to the commands supported by the standard (non-SED) models as listed in **Table 10**:

Trusted Send  
Trusted Receive

### 4.10 RevertSP

SED models will support the RevertSP feature which erases all data in all bands on the device and returns the contents of all SPs (Security Providers) on the device to their original factory state. In order to execute the RevertSP method the unique PSID (Physical Secure ID) printed on the drive label must be provided. PSID is not electronically accessible and can only be manually read from the drive label or scanned in via the 2D barcode.



## 5.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 5.1 Hot-Plug compatibility

Desktop HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 5.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATA connector pin definitions

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			
Power	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

#### Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
  - All used voltage pins (V<sub>x</sub>) must be terminated.

### 5.3 Supported ATA commands

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 36 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 10 SATA standard commands**

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>

Table 10 SATA standard commands (continued)

Command name	Command code (in hex)	
Security Freeze	F5 <sub>H</sub>	
Security Set Password	F1 <sub>H</sub>	
Security Unlock	F2 <sub>H</sub>	
Seek	70 <sub>H</sub>	
Set Features	EF <sub>H</sub>	
Set Max Address	F9 <sub>H</sub>	
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Address:	00 <sub>H</sub>
	Password:	01 <sub>H</sub>
	Lock:	02 <sub>H</sub>
	Unlock:	03 <sub>H</sub>
	Freeze Lock:	04 <sub>H</sub>
Set Max Address Extended	37 <sub>H</sub>	
Set Multiple Mode	C6 <sub>H</sub>	
Sleep	E6 <sub>H</sub>	
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>	
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>	
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>	
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>	
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>	
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>	
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>	
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>	
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>	
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>	
Standby	E2 <sub>H</sub>	
Standby Immediate	E0 <sub>H</sub>	
Write Buffer	E8 <sub>H</sub>	
Write DMA	CA <sub>H</sub>	
Write DMA Extended	35 <sub>H</sub>	
Write DMA FUA Extended	3D <sub>H</sub>	
Write DMA Without Retries	CB <sub>H</sub>	
Write Log Extended	3F <sub>H</sub>	
Write Multiple	C5 <sub>H</sub>	
Write Multiple Extended	39 <sub>H</sub>	
Write Multiple FUA Extended	CE <sub>H</sub>	
Write Sectors	30 <sub>H</sub>	
Write Sectors Without Retries	31 <sub>H</sub>	
Write Sectors Extended	34 <sub>H</sub>	
Write Uncorrectable	45 <sub>H</sub>	

### 5.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 29. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>

Table 11 Identify Device commands (continued)

Word	Description	Value
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFF <sub>h</sub> (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFF <sub>h</sub> in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFF <sub>h</sub> *
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>

Table 11 Identify Device commands (continued)

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFH.	ST3000DM001 = 5,860,533,168 ST3000DM002 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST2000DM002 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST1000DM004 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.



	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 5.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.



### 5.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 13 S.M.A.R.T. commands**

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.



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## Exhibit 14



# Desktop HDD

Product Manual

## Standard models

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

## Self-Encryption models

ST3000DM002  
ST2000DM002  
ST1000DM004

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Revision	Date	Description of Change
Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times, Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)
Rev. J	05/08/2014	Updated product name (pages fc, 2, 19 & 22) and Add metric "mm" values to mechanical drawings. (pages 20-21).
Rev. K	08/28/2014	Add SED models and SED Section 4.0 (pages: fc, 2, 4, 7, 22-23 & 29)
Rev. L	01/26/2015	Applied new logo (pages: fc & bc), applied latest page numbering convention (pages: all), added AFR = <1.0% & update Rated Workload text (pages: 9 & 11), added Case Temp note & changed "&" to "%" in Storage note (page: 17), add Reliability Section 2.12 (page: 20), cleaned up text in Mechanical Drawings (pages: 24-25) & revised SED section 4.0 (pages: 26-27).
Rev. M	03/10/2015	Change Max Case Temperature to 69°C (page: 17)
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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit [www.bis.doc.gov](http://www.bis.doc.gov)), and controlled for import and use outside of the U.S. Seagate reserves the right to change, without notice,

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Available services include:

- Presales & Technical support
- Global Support Services telephone numbers & business hours
- Authorized Service Centers

For information regarding Warranty Support, visit: <http://www.seagate.com/support/warranty-and-replacements/>

For information regarding data recovery services, visit: <http://www.seagate.com/services-software/seagate-recovery-services/recover/>

For Seagate OEM and Distribution partner portal, visit: <http://www.seagate.com/partners/>

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## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following:  
Seagate® Desktop HDD model drives:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

Previous generations of Seagate Self-Encrypting Drive models were called Full Disk Encryption (FDE) models before a differentiation between drive-based encryption and other forms of encryption was necessary.

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queuing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

## 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.

- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.

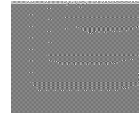
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).



The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1** Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in		146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical		
Startup current 12V	2.0A or 2.8A		2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		

**Table 1** Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Ambient temperature	0° to 60°C (operating) –40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)		
Altitude, operating	–304.8m to 3048m (–1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	–304.8m to 12,192m (–1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power Idle***	2.4 bels (typical) 2.6 bels (max)		2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)		2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Annualized FailureRate (AFR)	<1.0% based on 2400 POH		
Maximum Rated workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2		1
Disks	1		
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1413kb/in		
Track density (avg)	236ktracks/in		
Areal density (avg)	329Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	1695Mb/s		
Average Data Rate, read/write (MB/s)	125MB/s		
Maximum sustained data transfer rate, OD read	144MB/s		
I/O data-transfer rate (max.)	600MB/s		
Cache buffer	16MB		
Height (max)	19.98mm / 0.787 in		
Width (max)	101.6mm / 4.0 in (± 0.010 in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	415g / 0.915 lb		
Average latency	4.16ms		
Power-on to ready (max)	<8.5s		
Standby to ready (max)	<8.5s		
Average seek, read (typical)	<8.5ms (read)		
Average seek, write (typical)	<9.5ms (write)		
Startup current (typical) 12V	2.0A		
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms		
Non-operational shock (max)	350 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			

**Table 2** Drive specifications summary for 500GB, 320GB and 250GB models (continued)

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Idle***		2.2 bels (typical) 2.3 bels (max)	
Seek		2.3 bels (typical) 2.4 bels (max)	
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Maximum Rated workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001 ST3000DM002	3000GB	5,860,533,168	4K
ST2000DM001 ST2000DM002	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003 ST1000DM004	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.



### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 5.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

### 2.3 Default logical geometry

**Cylinders:** 16,383

**Read/write heads:** 16

**Sectors per track:** 63

#### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

### 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 $\pm$ 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600



## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB, 750GB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in (± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	3-disk (3TB, 2TB models)	2-disk (2TB, 1.5TB models)	1-disk (1TB, 750GB models)	1-disk (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Powerspecifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 23**.

### 2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3, Table 4, Table 5 and Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

#### Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

#### Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

#### Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

#### Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

#### Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3** DC power requirements (3-disk: 3TB and 2TB models)

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4** DC power requirements (2-disk: 2TB and 1.5TB models)

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5** DC power requirements (1-disk: 1TB and 750GB models)

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6** DC power requirements (1-disk: 500, 320 and 250GB models)

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

## 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V  $\pm 5\%$

12V  $+10\%$  /  $-7.5\%$

## 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

### Active mode

The drive is in Active mode during the read/write and seek operations.

### Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

### Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the **drive buffer is enabled**, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

### Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

### Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.

	The maximum allowable drive case temperature is 69°C. See Figures 2 & 3 for HDA case temperature measurement locations.
--	----------------------------------------------------------------------------------------------------------------------------

Refer to Section 3.4 Drive mounting for base plate measurement location.

### 2.9.1 Ambient temperature

Operating	0° to 60°C (32° to 140°F)
Non-operating	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

Operating	20°C per hour (68°F per hour max), without condensation
Non-operating	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

Operating	5% to 95% non-condensing (30% per hour max)
Nonoperating	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

Operating	37.7°C (99.9°F max)
Non-operating	40°C (104°F max)

### 2.9.4 Altitude

Operating	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
Non-operating	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

	Maximum storage condition not to exceed 90 days at a wetbulb temperature of 32°C (example: 34°C / 90%RH)
--	----------------------------------------------------------------------------------------------------------

## 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

### 2.9.5.2 Non-operating shock

#### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

#### 1TB, 750GB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

### 2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

## 2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs



## 2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

	<p>For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:</p> $(\text{Number of seeks per second} = 0.4 / (\text{average latency} + \text{average access time}))$
--	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (2TB, 1.5TB)		
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

### 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in **Table 8**.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Reliability

### 2.12.1 Annualized Failure Rate (AFR)

The production disk drive shall achieve an annualized failure-rate of <1.0% over a 5 year service life when used in Desktop Storage field conditions as limited by the following:

2400 power-on-hours per year.

Typical workload

Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read, max
Maximum Rated Workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on the "Check to see if the drive is under Warranty" link. The following are required to be provided: the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.
Preventive maintenance	None required.

## 2.13 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:

<http://www.seagate.com/support/warranty-and-replacements/>

From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.

## 2.14 Agency certification

### 2.14.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.14.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.



**Korean RRL**

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-FEM-STX-Barracuda

**Australian C-Tick (N176)**

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

**2.14.3 FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

Reorient the receiving antenna.

Move the device to one side or the other of the radio or TV.

Move the device farther away from the radio or TV.

Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

## 2.15 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

### 2.15.1 European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

### 2.15.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

## 2.16 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until mounting it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

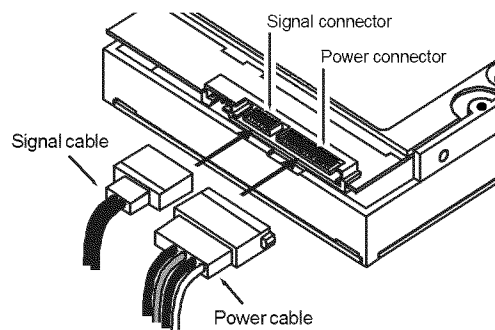
### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See **Table 9** for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in **Figure 1**.

**Figure 1** Attaching SATA cabling



Each cable is keyed to ensure correct orientation. Desktop HDD drives support latching SATA connectors.

### 3.4 Drive mounting

Users can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2** and **Figure 3** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

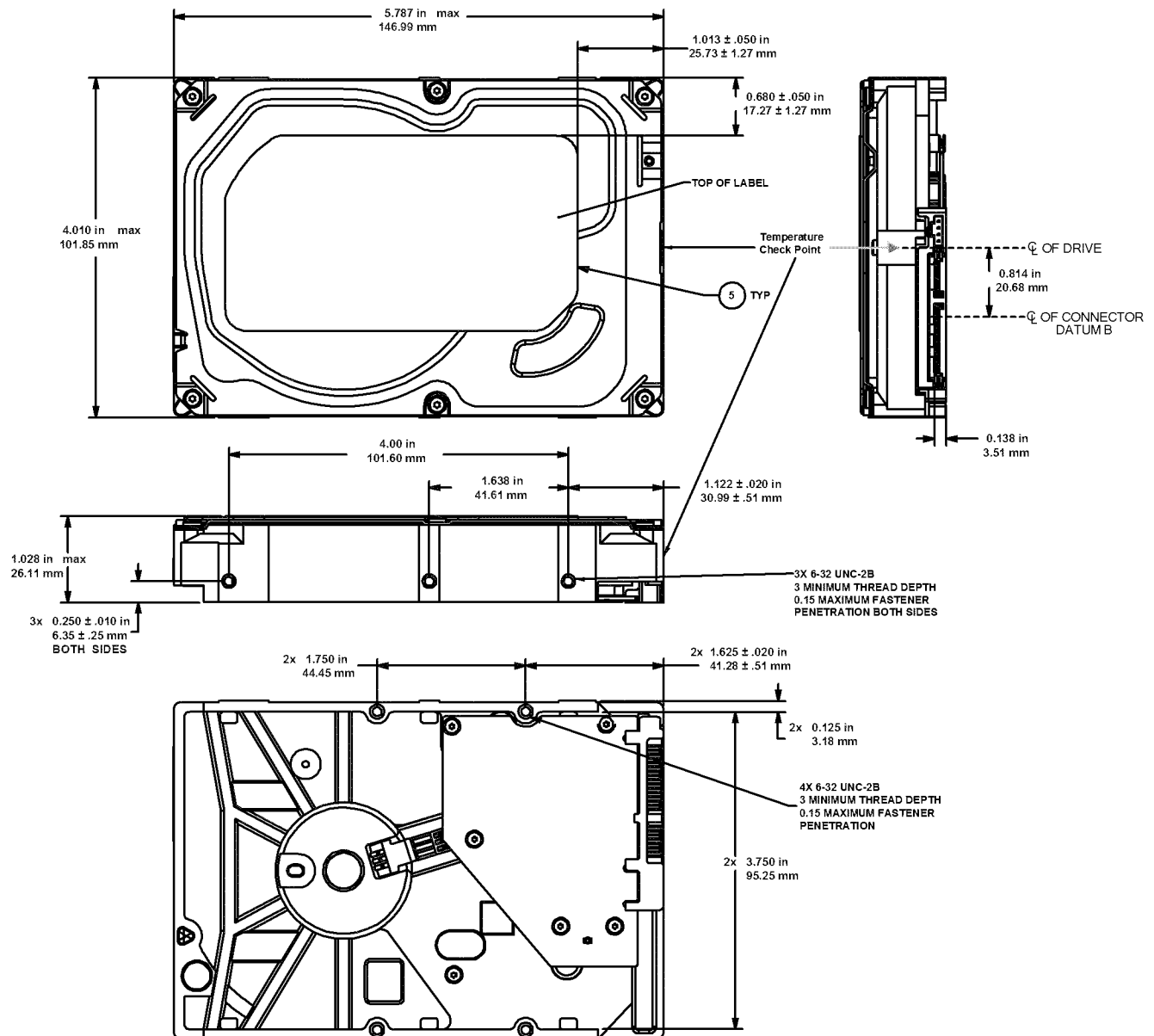
Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

Use only 6-32 UNC mounting screws.

The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.

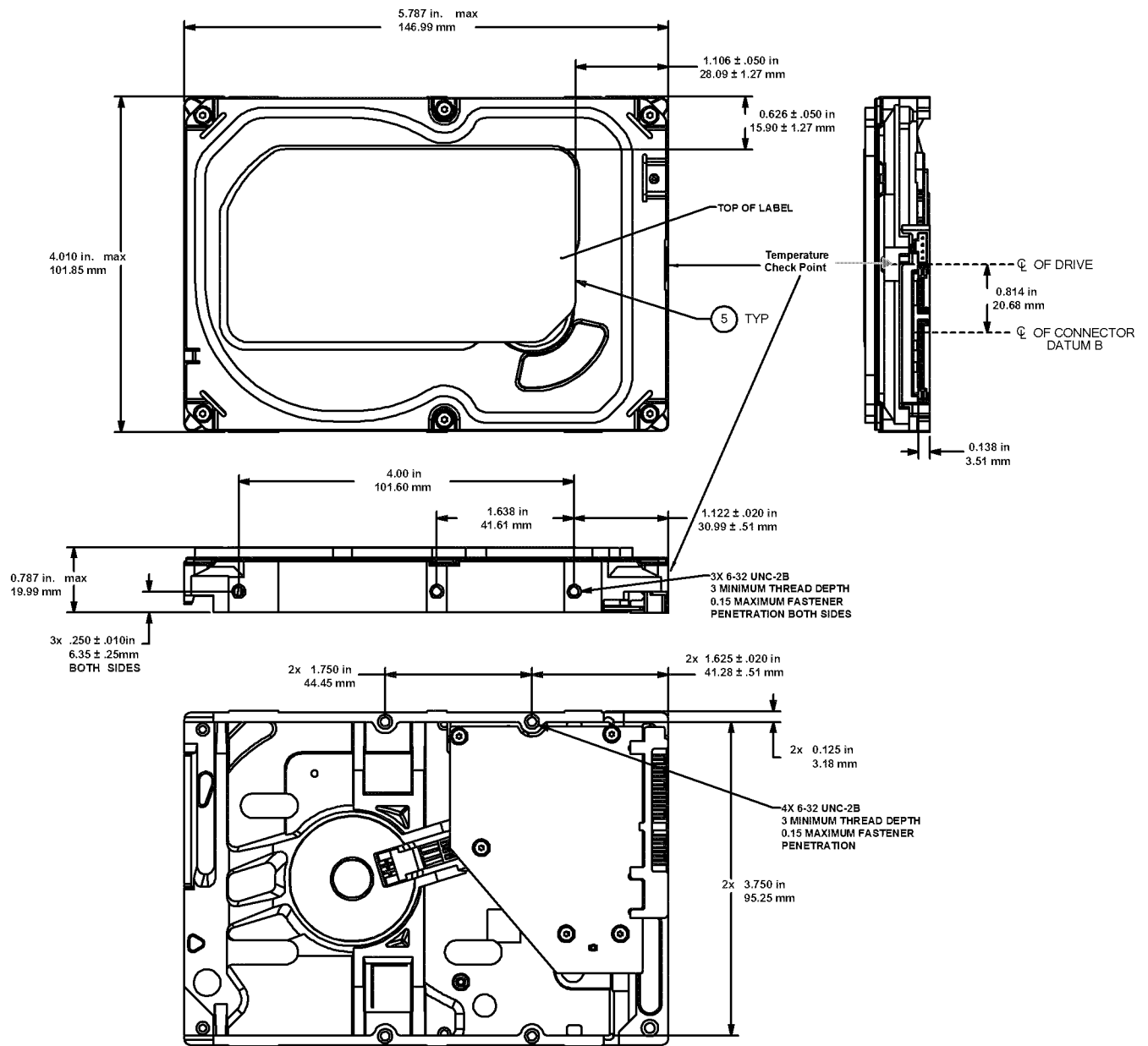
Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2** Mounting dimensions (3-disk: 1.5TB to 3TB models)



Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.

Figure 3 Mounting dimensions (1-disk: 250GB to 1TB models)



Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.



## 4.0 About (SED) Self-Encrypting Drives

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Self-encrypting drives (SEDs) offer encryption and security services for the protection of stored data, commonly known as "data at rest". These drives are compliant with the Trusted Computing Group (TCG) Opal Storage Specifications as detailed in the following:

TCG Storage Architecture Core Specification, Version 2.0 (see [www.trustedcomputinggroup.org](http://www.trustedcomputinggroup.org))

TCG Storage Security Subsystem Class Opal Specification, Version 2.0 (see [www.trustedcomputinggroup.org](http://www.trustedcomputinggroup.org))

In case of conflict between this document and any referenced document, this document takes precedence.

The Trusted Computing Group (TCG) is a standards organization sponsored and operated by companies in the computer, storage and digital communications industry. Seagate's SED models comply with the standards published by the TCG.

To use the security features in the drive, the host must be capable of constructing and issuing the following two SATA commands:

Trusted Send

Trusted Receive

These commands are used to convey the TCG protocol to and from the drive in their command payloads. Seagate Secure SEDs also support TCG Single User Mode, which can be disabled.

### 4.1 Data Encryption

Encrypting drives use one inline encryption engine within each drive employing AES-256 algorithms in Cipher Block Chaining (CBC) mode to encrypt all data prior to being written on the media and to decrypt all data as it is read from the media. The encryption engine is always in operation and cannot be disabled. The 32-byte Data Encryption Key (DEK) is a random number which is generated by the drive, never leaves the drive, and is inaccessible to the host system. The DEK is itself encrypted when it is stored on the media and when in volatile temporary storage (DRAM), which is external to the encryption engine. A unique data encryption key is used for each of the drive's possible 16 data bands (see **Section 4.5 Data Bands**).

### 4.2 Controlled Access

The drive has two security providers (SPs) called the "Admin SP" and the "Locking SP." These act as gatekeepers to the drive security services. Security-related commands will not be accepted unless the user provides the correct credentials to prove that they are authorized to perform the command.

#### 4.2.1 Admin SP

The Admin SP allows the drive's owner to enable or disable firmware download operations (see **Section 4.4 Drive Locking**). Access to the Admin SP is available using the SID (Secure ID) password.

#### 4.2.2 Locking SP

The Locking SP controls read/write access to the media and the cryptographic erase feature. Access to the Locking SP is available using the Admin or User passwords.

#### 4.2.3 Default password

When the drive is shipped from the factory, all passwords are set to the value of MSID. This 32-byte random value can only be read by the host electronically over the interface. After receipt of the drive, it is the responsibility of the owner to use the default MSID password as the authority to change all other passwords to unique owner-specified values.

#### 4.2.4 ATA Enhanced Security

The drive can utilize the system's BIOS through the ATASecurity API for cases that do not require password management and additional security policies.

Furthermore, the drive's ATASecurity Erase Unit command shall support both Normal and Enhanced Erase modes with the following modifications/additions:

**Normal Erase:** Normal erase feature shall be performed by changing the Data Encryption Key (DEK) of the drive, followed by an overwrite operation that repeatedly writes a single sector containing random data to the entire drive. This write operation bypasses the media encryption. On reading back the overwritten sectors, the host will receive a decrypted version, using the new DEK of the random data sector (the returned data will not match what was written).

**Enhanced Erase:** Enhanced erase shall be performed by changing the Data Encryption Key of the drive.

### 4.3 Random Number Generator (RNG)

The drive has a 32-byte hardware RNG that it uses to derive encryption keys or, if requested to do so, to provide random numbers to the host for system use, including using these numbers as Authentication Keys (passwords) for the drive's Admin and Locking SPs.

## 4.4 Drive Locking

In addition to changing the passwords, as described in **Section 4.2.3 Default password**, the owner should also set the data access controls for the individual bands.

The variable "LockOnReset" should be set to "PowerCycle" to ensure that the data bands will be locked if power is lost. In addition "ReadLockEnabled" and "WriteLockEnabled" must be set to true in the locking table in order for the bands "LockOnReset" setting of "PowerCycle" to actually lock access to the band when a "PowerCycle" event occurs. This scenario occurs if the drive is removed from its cabinet. The drive will not honor any data read or write requests until the bands have been unlocked. This prevents the user data from being accessed without the appropriate credentials when the drive has been removed from its cabinet and installed in another system.

## 4.5 Data Bands

When shipped from the factory, the drive is configured with a single data band called Band 0 (also known as the Global Data Band) which comprises LBA 0 through LBA max. The host may allocate additional bands (Band1 to Band15) by specifying a start LBA and an LBA range. The real estate for this band is taken from the Global Band.

Data bands cannot overlap but they can be sequential with one band ending at LBA (x) and the next beginning at LBA (x+1).

Each data band has its own drive-generated encryption key. The host may change the Encryption Key (see **Section 4.6 Cryptographic Erase**) or the password when required.

## 4.6 Cryptographic Erase

A valuable feature of SEDs is the ability to perform a cryptographic erase. This involves the host telling the drive to change the data encryption key for a particular band. Once changed, the data is no longer recoverable since it was written with one key and will be read using a different key. Since the drive overwrites the old key with the new one, and keeps no history of key the older key, the user data can never be recovered. This is done in a matter of seconds and is very useful if the drive is to be scrapped or repurposed.

## 4.7 Authenticated Firmware Download

In addition to providing a locking mechanism to prevent unwanted firmware download attempts, the drive also only accepts download files which have been cryptographically signed by the appropriate Seagate Design Center.

Three conditions must be met before the drive will allow the download operation:

1. The download must be an SED file. A standard drive (non-SED) file will be rejected.
2. The download file must be signed and authenticated.
3. As with a non-SED drive, the download file must pass the acceptance criteria for the drive. For example it must be applicable to the correct drive model, and have compatible revision and customer status.

## 4.8 Power Requirements

The standard drive models and the SED drive models have identical hardware, however the security and encryption portion of the drive controller ASIC is enabled and functional in the SED models. This represents a small additional drain on the 5V supply of about

30mA and a commensurate increase of about 150mW in power consumption. There is no additional drain on the 12V supply. See the tables in **Section 2.8 Power specifications** for power requirements on the standard (non-SED) drive models.

## 4.9 Supported Commands

The SED models support the following two commands in addition to the commands supported by the standard (non-SED) models as listed in **Table 10**:

Trusted Send  
Trusted Receive

## 4.10 RevertSP

SED models will support the RevertSP feature which erases all data in all bands on the device and returns the contents of all SPs (Security Providers) on the device to their original factory state. In order to execute the RevertSP method the unique PSID (Physical Secure ID) printed on the drive label must be provided. PSID is not electronically accessible and can only be manually read from the drive label or scanned in via the 2D barcode.

## 5.0 SATAInterface

These drives use the industry-standard Serial ATA(SATA)interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATAinterface, refer to the "Serial ATA:High Speed Serialized ATAttachment" specification.

### 5.1 Hot-Plug compatibility

Desktop HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 5.2 SATA device plug connector pin definitions

**Table 9** summarizes the signals on the SATA interface and power connectors.

**Table 9** SATAconnector pin definitions

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			
Power	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

#### Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
  - All used voltage pins (V<sub>x</sub>) must be terminated.



### 5.3 Supported ATAcommands

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization:

Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See "S.M.A.R.T. commands" on page 36 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 10** SATA standard commands

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>

Table 10 SATA standard commands (continued)

Command name	Command code (in hex)
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address	F9 <sub>H</sub>
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	<div>Address: 00<sub>H</sub></div> <div>Password: 01<sub>H</sub></div> <div>Lock: 02<sub>H</sub></div> <div>Unlock: 03<sub>H</sub></div> <div>Freeze Lock: 04<sub>H</sub></div>
Set Max Address Extended	37 <sub>H</sub>
Set Multiple Mode	C6 <sub>H</sub>
Sleep	E6 <sub>H</sub>
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>
Standby	E2 <sub>H</sub>
Standby Immediate	E0 <sub>H</sub>
Write Buffer	E8 <sub>H</sub>
Write DMA	CA <sub>H</sub>
Write DMA Extended	35 <sub>H</sub>
Write DMA FUA Extended	3D <sub>H</sub>
Write DMA Without Retries	CB <sub>H</sub>
Write Log Extended	3F <sub>H</sub>
Write Multiple	C5 <sub>H</sub>
Write Multiple Extended	39 <sub>H</sub>
Write Multiple FUA Extended	CE <sub>H</sub>
Write Sectors	30 <sub>H</sub>
Write Sectors Without Retries	31 <sub>H</sub>
Write Sectors Extended	34 <sub>H</sub>
Write Uncorrectable	45 <sub>H</sub>

### 5.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 29. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>

Table 11 Identify Device commands (continued)

Word	Description	Value
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>

Table 11 Identify Device commands (continued)

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFh.	ST3000DM001 = 5,860,533,168 ST3000DM002 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST2000DM002 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST1000DM004 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.

	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 5.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.



### 5.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 13 S.M.A.R.T. commands**

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.





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August 2015*

# Exhibit 15



# Desktop HDD

Product Manual

## Standard models

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

## Self-Encryption models

ST3000DM002  
ST2000DM002  
ST1000DM004

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Revision	Date	Description of Change
Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)
Rev. J	05/08/2014	Updated product name (pages fc, 2, 19 & 22) and Add metric "mm" values to mechanical drawings. (pages 20-21).
Rev. K	08/28/2014	Add SED models and SED Section 4.0 (pages: fc, 2, 4, 7, 22-23 & 29)
Rev. L	01/26/2015	Applied new logo (pages: fc & bc), applied latest page numbering convention (pages: all), added AFR = <1.0% & update Rated Workload text (pages: 9 & 11), added Case Temp note & changed "&" to "%" in Storage note (page: 17), add Reliability Section 2.12 (page: 20), cleaned up text in Mechanical Drawings (pages: 24-25) & revised SED section 4.0 (pages: 26-27).
Rev. M	03/10/2015	Change Max Case Temperature to 69°C (page: 17)
Rev. N	08/18/2015	New cover design (page: fc) Replaced mechanical drawings to correct side hole dimension (pages: 24-25)
Rev. P	09/01/2015	Revised Rated Workload statement (pages: 9, 11 & 20)

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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit [www.bis.doc.gov](http://www.bis.doc.gov)), and controlled for import and use outside of the U.S. Seagate reserves the right to change, without notice, product offerings or specifications.

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## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following:  
Seagate® Desktop HDD model drives:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

**Note**

Previous generations of Seagate Self-Encrypting Drive models were called Full Disk Encryption (FDE) models before a differentiation between drive-based encryption and other forms of encryption was necessary.

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGM recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queuing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

## 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

### Note

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

### 2.1 Specification summary tables

The specifications listed in [1](#) and [2](#) are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specification summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in		146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical		
Startup current 12V	2.0A or 2.8A		2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		

**Table 1** Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power Idle*** Seek	2.4 bels (typical) 2.6 bels (max) 2.6 bels (typical) 2.7 bels (max)		2.2 bels (typical) 2.4 bels (max) 2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 2** Drive specifications summary for 500GB, 320GB and 250GB models

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2		1
Disks	1		
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1413kb/in		
Track density (avg)	236ktracks/in		
Areal density (avg)	329Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	1695Mb/s		
Average Data Rate, read/write (MB/s)	125MB/s		
Maximum sustained data transfer rate, OD read	144MB/s		
I/O data-transfer rate (max.)	600MB/s		
Cache buffer	16MB		
Height (max)	19.98mm / 0.787 in		
Width (max)	101.6mm / 4.0 in (± 0.010 in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	415g / 0.915 lb		
Average latency	4.16ms		
Power-on to ready (max)	<8.5s		
Standby to ready (max)	<8.5s		
Average seek, read (typical)	<8.5ms (read)		
Average seek, write (typical)	<9.5ms (write)		
Startup current (typical) 12V	2.0A		
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms		
Non-operational shock (max)	350 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			

**Table 2** Drive specifications summary for 500GB, 320GB and 250GB models (continued)

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Idle***		2.2 bels (typical) 2.3 bels (max)	
Seek		2.3 bels (typical) 2.4 bels (max)	
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001 ST3000DM002	3000GB	5,860,533,168	4K
ST2000DM001 ST2000DM002	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003 ST1000DM004	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

## 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 5.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

## 2.3 Default logical geometry

- **Cylinders:** 16,383
- **Read/write heads:** 16
- **Sectors per track:** 63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600

## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB, 750GB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in (± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

- Track-to-track seek time is an average of all possible single-track seeks in both directions.
- Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

### Note

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.



## 2.7 Start/stop times

	<b>3-disk</b> (3TB, 2TB models)	<b>2-disk</b> (2TB, 1.5TB models)	<b>1-disk</b> (1TB, 750GB models)	<b>1-disk</b> (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Powerspecifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to

23.

### 2.8.1 Powerconsumption

Power requirements for the drives are listed in 3, 4, 5 and 6. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

- **Spinup power**  
Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.
- **Read/write power and current**  
Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.
- **Operating power and current**  
Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.
- **Idle mode power**  
Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.
- **Standby mode**  
During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

- Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.
- Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

### Note

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

## 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

- 5V  $\pm 5\%$
- 12V +10% / -7.5%

## 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

- **Active mode**  
The drive is in Active mode during the read/write and seek operations.
- **Idle mode**  
The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.
- **Standby mode**  
The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.
- **Sleep mode**  
The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.
- **Idle and Standby timers**  
Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.

**Note**

The maximum allowable drive case temperature is 69°C.  
See Figures 2 & 3 for HDA case temperature measurement locations.

Refer to [mounting](#) for base plate measurement location.

### 2.9.1 Ambient temperature

<b>Operating</b>	0° to 60°C (32° to 140°F)
<b>Non-operating</b>	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

<b>Operating</b>	20°C per hour (68°F per hour max), without condensation
<b>Non-operating</b>	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

<b>Operating</b>	5% to 95% non-condensing (30% per hour max)
<b>Nonoperating</b>	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

<b>Operating</b>	37.7°C (99.9°F max)
<b>Non-operating</b>	40°C (104°F max)

### 2.9.4 Altitude

<b>Operating</b>	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
<b>Non-operating</b>	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

**Note**

Maximum storage condition not to exceed 90 days at a wetbulb temperature of 32°C (example: 34°C / 90%RH)



## 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

### 2.9.5.2 Non-operating shock

#### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

#### 1TB, 750GB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

### 2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

## 2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

## 2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note**

For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

(Number of seeks per second =  $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (2TB, 1.5TB)		
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

### 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in 8.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Reliability

### 2.12.1 Annualized Failure Rate (AFR)

The production disk drive shall achieve an annualized failure-rate of <1.0% over a 5 year service life when used in Desktop Storage field conditions as limited by the following:

- 2400 power-on-hours per year.
- Typical workload

Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read, max
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on the "Check to see if the drive is under Warranty" link. The following are required to be provided: the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.
Preventive maintenance	None required.

## 2.13 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:  
<http://www.seagate.com/support/warranty-and-replacements/>

From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.

## 2.14 Agency certification

### 2.14.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.14.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

**Korean RRL**

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

- Family name: Barracuda
- Certificate number: KCC-REM-STX-Barracuda

**Australian C-Tick (N176)**

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

**2.14.3 FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.



## 2.15 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

### 2.15.1 European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

### 2.15.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

## 2.16 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

- Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.
- Handle the drive by its edges or frame *only*.
- The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.
- Always rest the drive on a padded, antistatic surface until mounting it in the computer.
- Do not touch the connector pins or the printed circuit board.
- Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

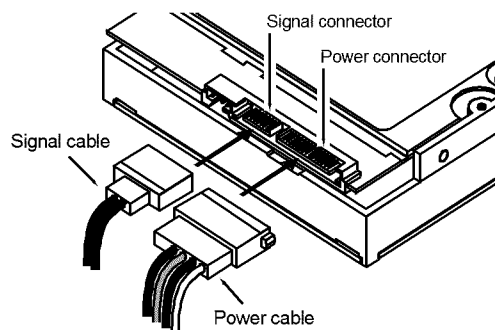
### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See 9 for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in 1.

**Figure 1 Attaching SATA cabling**



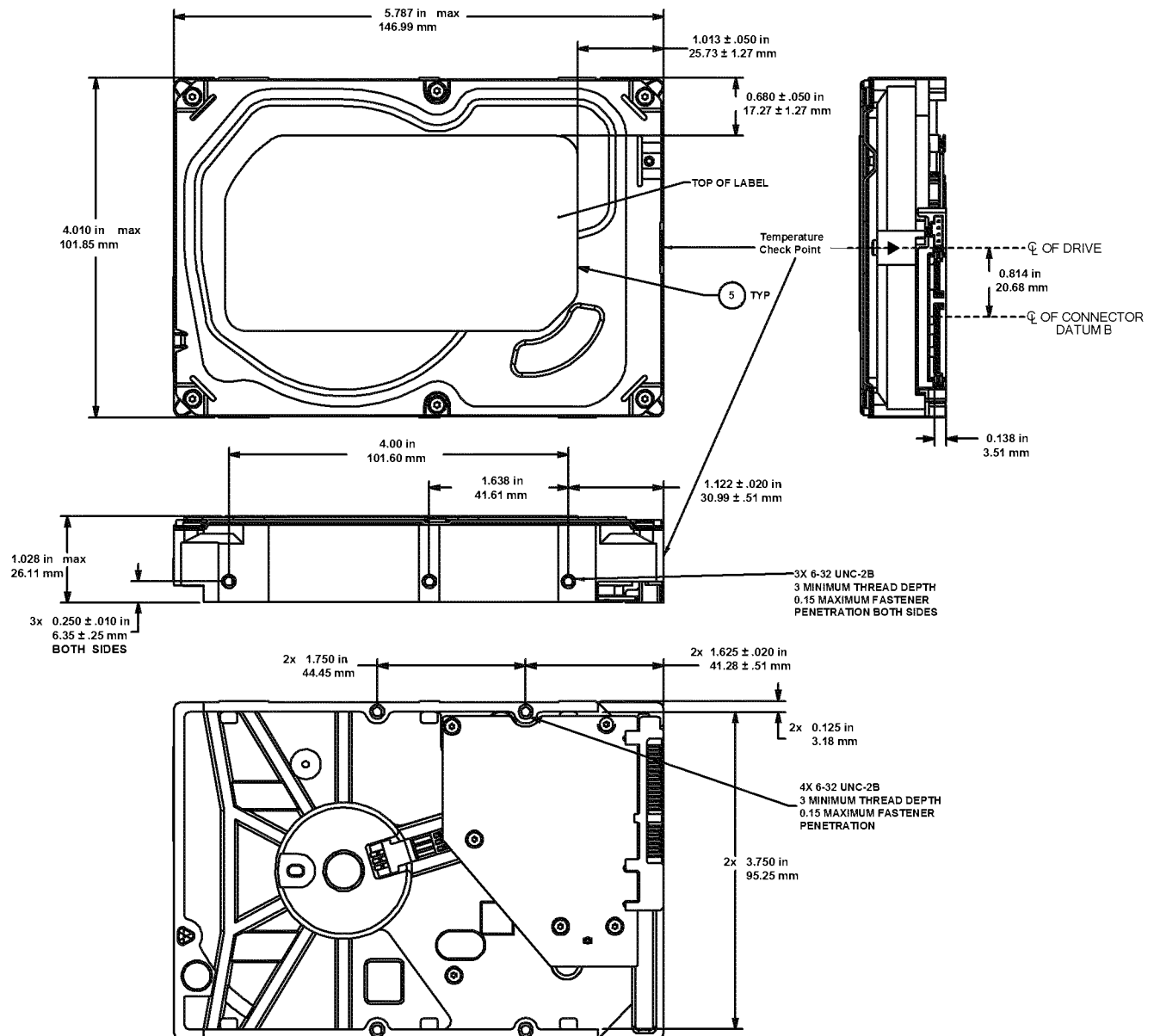
Each cable is keyed to ensure correct orientation. Desktop HDD drives support latching SATA connectors.

### 3.4 Drive mounting

Users can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to 2 and 3 for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

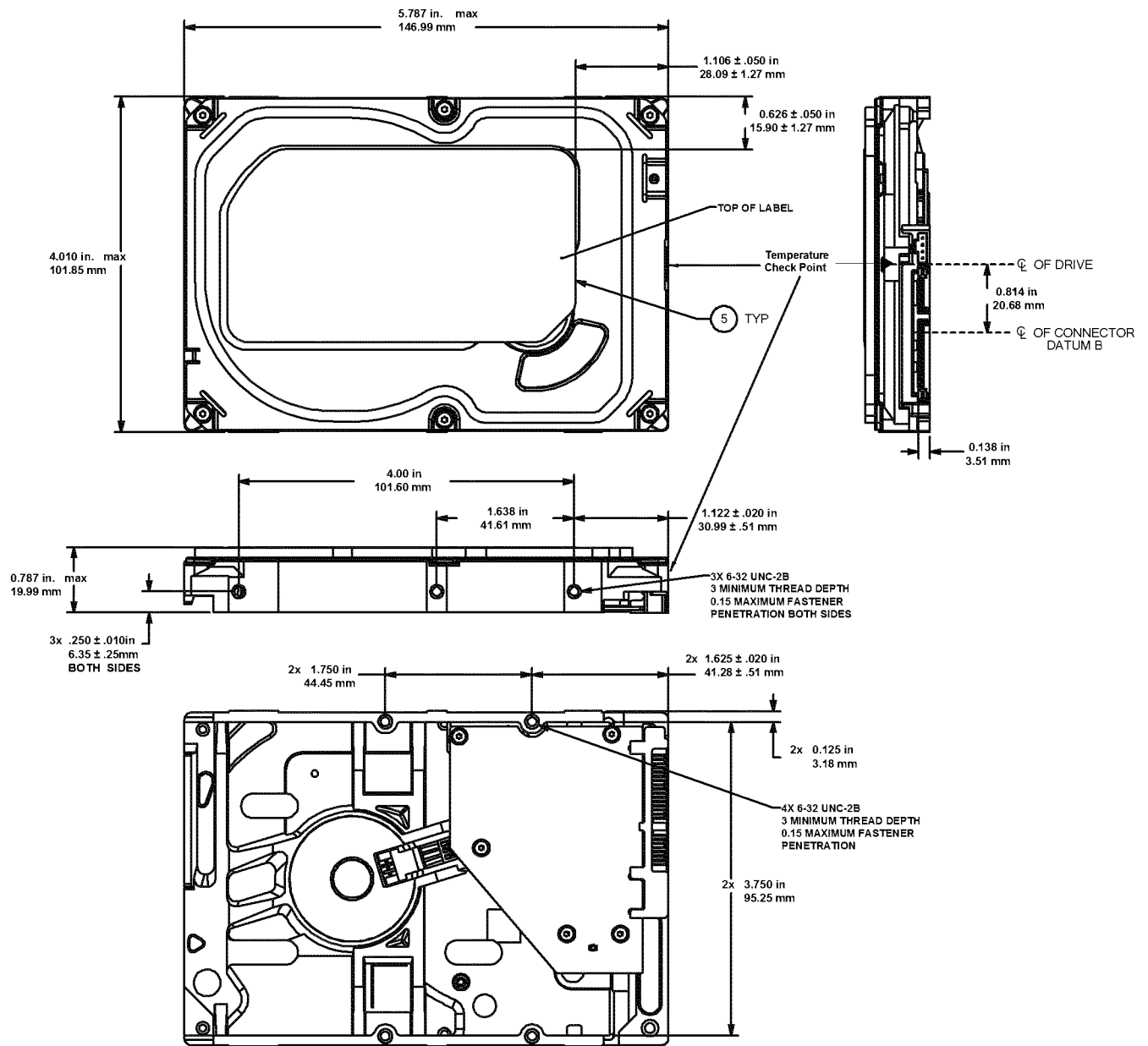
- Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.
- Use only 6-32 UNC mounting screws.
- The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.
- Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2 Mounting dimensions (3-disk: 1.5TB to 3TB models)**



**Note**

Drawings are for mounting hole reference only. PCBA show in pictorial only and can vary based on specific customer configurations.

**Figure 3 Mounting dimensions (1-disk: 250GB to 1TB models)****Note**

Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.

## 4.0 About (SED) Self-Encrypting Drives

Self-encrypting drives (SEDs) offer encryption and security services for the protection of stored data, commonly known as "data at rest". These drives are compliant with the Trusted Computing Group (TCG) Opal Storage Specifications as detailed in the following:

- TCG Storage Architecture Core Specification, Version 2.0 (see [www.trustedcomputinggroup.org](http://www.trustedcomputinggroup.org))
- TCG Storage Security Subsystem Class Opal Specification, Version 2.0 (see [www.trustedcomputinggroup.org](http://www.trustedcomputinggroup.org))

In case of conflict between this document and any referenced document, this document takes precedence.

The Trusted Computing Group (TCG) is a standards organization sponsored and operated by companies in the computer, storage and digital communications industry. Seagate's SED models comply with the standards published by the TCG.

To use the security features in the drive, the host must be capable of constructing and issuing the following two SATA commands:

- Trusted Send
- Trusted Receive

These commands are used to convey the TCG protocol to and from the drive in their command payloads. Seagate Secure SEDs also support TCG Single User Mode, which can be disabled.

### 4.1 Data Encryption

Encrypting drives use one inline encryption engine within each drive employing AES-256 algorithms in Cipher Block Chaining (CBC) mode to encrypt all data prior to being written on the media and to decrypt all data as it is read from the media. The encryption engine is always in operation and cannot be disabled. The 32-byte Data Encryption Key (DEK) is a random number which is generated by the drive, never leaves the drive, and is inaccessible to the host system. The DEK is itself encrypted when it is stored on the media and when in volatile temporary storage (DRAM), which is external to the encryption engine. A unique data encryption key is used for each of the drive's possible 16 data bands (see [Bands](#)).

### 4.2 Controlled Access

The drive has two security providers (SPs) called the "Admin SP" and the "Locking SP." These act as gatekeepers to the drive security services. Security-related commands will not be accepted unless the user provides the correct credentials to prove that they are authorized to perform the command.

#### 4.2.1 Admin SP

The Admin SP allows the drive's owner to enable or disable firmware download operations (see [Firmware Download](#)). Access to the Admin SP is available using the SID (Secure ID) password.

[Locking](#)). Access

#### 4.2.2 Locking SP

The Locking SP controls read/write access to the media and the cryptographic erase feature. Access to the Locking SP is available using the Admin or User passwords.

#### 4.2.3 Default password

When the drive is shipped from the factory, all passwords are set to the value of MSID. This 32-byte random value can only be read by the host electronically over the interface. After receipt of the drive, it is the responsibility of the owner to use the default MSID password as the authority to change all other passwords to unique owner-specified values.

#### 4.2.4 ATA Enhanced Security

The drive can utilize the system's BIOS through the ATASecurity API for cases that do not require password management and additional security policies.

Furthermore, the drive's ATASecurity Erase Unit command shall support both Normal and Enhanced Erase modes with the following modifications/additions:

**Normal Erase:** Normal erase feature shall be performed by changing the Data Encryption Key (DEK) of the drive, followed by an overwrite operation that repeatedly writes a single sector containing random data to the entire drive. This write operation bypasses the media encryption. On reading back the overwritten sectors, the host will receive a decrypted version, using the new DEK of the random data sector (the returned data will not match what was written).

**Enhanced Erase:** Enhanced erase shall be performed by changing the Data Encryption Key of the drive.

### 4.3 Random Number Generator (RNG)

The drive has a 32-byte hardware RNG that it uses to derive encryption keys or, if requested to do so, to provide random numbers to the host for system use, including using these numbers as Authentication Keys (passwords) for the drive's Admin and Locking SPs.

## 4.4 Drive Locking

In addition to changing the passwords, as described in

password, the owner should also set the data access

The variable "LockOnReset" should be set to "PowerCycle" to ensure that the data bands will be locked if power is lost. In addition "ReadLockEnabled" and "WriteLockEnabled" must be set to true in the locking table in order for the bands "LockOnReset" setting of "PowerCycle" to actually lock access to the band when a "PowerCycle" event occurs. This scenario occurs if the drive is removed from its cabinet. The drive will not honor any data read or write requests until the bands have been unlocked. This prevents the user data from being accessed without the appropriate credentials when the drive has been removed from its cabinet and installed in another system.

## 4.5 Data Bands

When shipped from the factory, the drive is configured with a single data band called Band 0 (also known as the Global Data Band) which comprises LBA 0 through LBA max. The host may allocate additional bands (Band1 to Band15) by specifying a start LBA and an LBA range. The real estate for this band is taken from the Global Band.

Data bands cannot overlap but they can be sequential with one band ending at LBA (x) and the next beginning at LBA (x+1).

Each data band has its own drive-generated encryption key. The host may change the Encryption Key (see Erase) or the password when required.

## 4.6 Cryptographic Erase

A valuable feature of SEDs is the ability to perform a cryptographic erase. This involves the host telling the drive to change the data encryption key for a particular band. Once changed, the data is no longer recoverable since it was written with one key and will be read using a different key. Since the drive overwrites the old key with the new one, and keeps no history of key the older key, the user data can never be recovered. This is done in a matter of seconds and is very useful if the drive is to be scrapped or repurposed.

## 4.7 Authenticated Firmware Download

In addition to providing a locking mechanism to prevent unwanted firmware download attempts, the drive also only accepts download files which have been cryptographically signed by the appropriate Seagate Design Center.

Three conditions must be met before the drive will allow the download operation:

1. The download must be an SED file. A standard drive (non-SED) file will be rejected.
2. The download file must be signed and authenticated.
3. As with a non-SED drive, the download file must pass the acceptance criteria for the drive. For example it must be applicable to the correct drive model, and have compatible revision and customer status.

## 4.8 Power Requirements

The standard drive models and the SED drive models have identical hardware, however the security and encryption portion of the drive controller ASIC is enabled and functional in the SED models. This represents a small additional drain on the 5V supply of about

30mA and a commensurate increase of about 150mW in power consumption. There is no additional drain on the 12V supply. See the tables in specifications for power requirements on the standard (non-SED) drive models.

## 4.9 Supported Commands

The SED models support the following two commands in addition to the commands supported by the standard (non-SED) models as listed in 10:

- Trusted Send
- Trusted Receive

## 4.10 RevertSP

SED models will support the RevertSP feature which erases all data in all bands on the device and returns the contents of all SPs (Security Providers) on the device to their original factory state. In order to execute the RevertSP method the unique PSID (Physical Secure ID) printed on the drive label must be provided. PSID is not electronically accessible and can only be manually read from the drive label or scanned in via the 2D barcode.

## 5.0 SATAInterface

These drives use the industry-standard Serial ATA(SATA)interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATAinterface, refer to the “Serial ATA:High Speed Serialized ATAttachment” specification.

### 5.1 Hot-Plug compatibility

Desktop HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 5.2 SATAdevice plug connector pin definitions

9 summarizes the signals on the SATAinterface and power connectors.

**Table 9 SATAconnector pin definitions**

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			
Power	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

#### Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
  - All used voltage pins (V<sub>x</sub>) must be terminated.



### 5.3 Supported ATAcommands

The following table lists SATAstandard commands that the drive supports.

For a detailed description of the ATAcommands, refer to the Serial ATAInternational Organization:

Serial ATARevision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 36 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 10 SATAstandard commands**

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>



**Table 10 SATA standard commands (continued)**

Command name	Command code (in hex)	
Security Freeze	F5 <sub>H</sub>	
Security Set Password	F1 <sub>H</sub>	
Security Unlock	F2 <sub>H</sub>	
Seek	70 <sub>H</sub>	
Set Features	EF <sub>H</sub>	
Set Max Address	F9 <sub>H</sub>	
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Address: Password: Lock: Unlock: Freeze Lock:	00 <sub>H</sub> 01 <sub>H</sub> 02 <sub>H</sub> 03 <sub>H</sub> 04 <sub>H</sub>
Set Max Address Extended	37 <sub>H</sub>	
Set Multiple Mode	C6 <sub>H</sub>	
Sleep	E6 <sub>H</sub>	
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>	
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>	
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>	
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>	
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>	
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>	
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>	
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>	
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>	
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>	
Standby	E2 <sub>H</sub>	
Standby Immediate	E0 <sub>H</sub>	
Write Buffer	E8 <sub>H</sub>	
Write DMA	CA <sub>H</sub>	
Write DMA Extended	35 <sub>H</sub>	
Write DMA FUA Extended	3D <sub>H</sub>	
Write DMA Without Retries	CB <sub>H</sub>	
Write Log Extended	3F <sub>H</sub>	
Write Multiple	C5 <sub>H</sub>	
Write Multiple Extended	39 <sub>H</sub>	
Write Multiple FUA Extended	CE <sub>H</sub>	
Write Sectors	30 <sub>H</sub>	
Write Sectors Without Retries	31 <sub>H</sub>	
Write Sectors Extended	34 <sub>H</sub>	
Write Uncorrectable	45 <sub>H</sub>	

### 5.3.1 Identify Device command

The Identify Device command (command code  $EC_H$ ) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 29. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: <ul style="list-style-type: none"> <li>• Bit 15: 0 = ATA; 1 = ATAPI</li> <li>• Bit 7: removable media</li> <li>• Bit 6: removable controller</li> <li>• Bit 0: reserved</li> </ul>	$0C5A_H$
1	Number of logical cylinders	16,383
2	ATA-reserved	$0000_H$
3	Number of logical heads	16
4	Retired	$0000_H$
5	Retired	$0000_H$
6	Number of logical sectors per logical track: 63	$003F_H$
7–9	Retired	$0000_H$
10–19	Serial number: (20 ASCII characters, $0000_H$ = none)	ASCII
20	Retired	$0000_H$
21	Retired	$0400_H$
22	Obsolete	$0000_H$
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	$8010_H$
48	Reserved	$0000_H$
49	Standard Standby timer, IORDY supported and may be disabled	$2F00_H$
50	ATA-reserved	$0000_H$
51	PIO data-transfer cycle timing mode	$0200_H$
52	Retired	$0200_H$
53	Words 54–58, 64–70 and 88 are valid	$0007_H$
54	Number of current logical cylinders	$xxxx_H$
55	Number of current logical heads	$xxxx_H$
56	Number of current logical sectors per logical track	$xxxx_H$
57–58	Current capacity in sectors	$xxxx_H$
59	Number of sectors transferred during a Read Multiple or Write Multiple command	$xxxx_H$

**Table 11 Identify Device commands (continued)**

Word	Description	Value
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATAcapabilities	xxxx <sub>H</sub>
77	Reserved for future SATAdefinition	xxxx <sub>H</sub>
78	SATAfeatures supported	xxxx <sub>H</sub>
79	SATAfeatures enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>

**Table 11 Identify Device commands (continued)**

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFH.	ST3000DM001 = 5,860,533,168 ST3000DM002 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST2000DM002 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST1000DM004 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

**Note**

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

**Note**

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.

	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 5.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets **BSY**, checks the contents of the Features register, clears **BSY** and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note**

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 5.3.3 S.M.A.R.T.commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 13 S.M.A.R.T.commands**

Code in features register	S.M.A.R.T.command
D0 <sub>H</sub>	S.M.A.R.T.Read Data
D2 <sub>H</sub>	S.M.A.R.T.Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T.Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T.Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T.Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T.Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T.Enable Operations
D9 <sub>H</sub>	S.M.A.R.T.Disable Operations
DA <sub>H</sub>	S.M.A.R.T.Return Status

**Note**

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.



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September 2015*



## Exhibit 16



# Desktop HDD

Product Manual

## Standard models

ST3000DM001  
ST2000DM001  
ST1500DM003  
ST1000DM003  
ST750DM003  
ST500DM002  
ST320DM000  
ST250DM000

## Self-Encryption models

ST3000DM002  
ST2000DM002  
ST1000DM004

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**Document Revision History**

Revision	Date	Description of Change
Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)
Rev. J	05/08/2014	Updated product name (pages fc, 2, 19 & 22) and Add metric "mm" values to mechanical drawings. (pages 20-21).
Rev. K	08/28/2014	Add SED models and SED Section 4.0 (pages: fc, 2, 4, 7, 22-23 & 29)
Rev. L	01/26/2015	Applied new logo (pages: fc & bc), applied latest page numbering convention (pages: all), added AFR = <1.0% & update Rated Workload text (pages: 9 & 11), added Case Temp note & changed "&" to "%" in Storage note (page: 17), add Reliability Section 2.12 (page: 20), cleaned up text in Mechanical Drawings (pages: 24-25) & revised SED section 4.0 (pages: 26-27).
Rev. M	03/10/2015	Change Max Case Temperature to 69°C (page: 17)
Rev. N	08/18/2015	New cover design (page: fc) Replaced mechanical drawings to correct side hole dimension (pages: 24-25)
Rev. P	09/01/2015	Revised Rated Workload statement (pages: 9, 11 & 20)
Rev. R	02/10/2016	4: Updated Support page 8 & 13: Updated drive weight to 415g / 0.915 lb; Updated 1TB, 750GB cache = 64MB/32MB 9, 10 & 17: Revised Wet Bulb to 26/29C rated 9, 11 & 20: Revised Warranty text to "Is my Drive under Warranty" 9: 1TB, 750GB Added Contact stop/start cycles = 50,000... 10 & 13: Updated 250, 320, 500GB cache = 32MB/16MB 11: Changed Byte/sector = 4096 20: Added Section 2.12.2 Storage 21: Revised Australian C-Tick to RCM 24-25: Corrected fastener penetration depth to 0.12 in. (text & drawings)

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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit [www.bis.doc.gov](http://www.bis.doc.gov)), and controlled for import and use outside of the U.S. Seagate reserves the right to change, without notice, product offerings or specifications.

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## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following:  
Seagate® Desktop HDD model drives:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

**Note**

Previous generations of Seagate Self-Encrypting Drive models were called Full Disk Encryption (FDE) models before a differentiation between drive-based encryption and other forms of encryption was necessary.

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGM recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queuing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.



## 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

### Note

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

## 2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

### 2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specification summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models**

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		64/32 MB
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in		146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	415g / 0.915 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical		
Startup current 12V	2.0A or 2.8A		2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		

**Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)**

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Ambient temperature	0° to 60°C (operating) –40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	26°C max (operating) 29°C max (nonoperating)		
Altitude, operating	–304.8m to 3048m (–1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	–304.8m to 12,192m (–1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power Idle***	2.4 bels (typical) 2.6 bels (max)		2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)		2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Is my Drive under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Contact start-stop cycles	----		50,000 at 25°C, 50% rel. humidity
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 2** Drive specifications summary for 500GB, 320GB and 250GB models

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2		1
Disks	1		
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1413kb/in		
Track density (avg)	236ktracks/in		
Areal density (avg)	329Gb/in <sup>2</sup>		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	1695Mb/s		
Average Data Rate, read/write (MB/s)	125MB/s		
Maximum sustained data transfer rate, OD read	144MB/s		
I/O data-transfer rate (max.)	600MB/s		
Cache buffer	32MB / 16 MB		
Height (max)	19.98mm / 0.787 in		
Width (max)	101.6mm / 4.0 in (± 0.010 in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	415g / 0.915 lb		
Average latency	4.16ms		
Power-on to ready (max)	<8.5s		
Standby to ready (max)	<8.5s		
Average seek, read (typical)	<8.5ms (read)		
Average seek, write (typical)	<9.5ms (write)		
Startup current (typical) 12V	2.0A		
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	26°C max (operating) 29°C max (nonoperating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms		
Non-operational shock (max)	350 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			

**Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)**

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Idle***		2.2 bels (typical) 2.3 bels (max)	
Seek		2.3 bels (typical) 2.4 bels (max)	
Non-recoverable read errors	1 per 10 <sup>14</sup> bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on "Is my Drive under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\* All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*\* During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001 ST3000DM002	3000GB	5,860,533,168	4096
ST2000DM001 ST2000DM002	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003 ST1000DM004	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

## 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 5.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

## 2.3 Default logical geometry

- **Cylinders:** 16,383
- **Read/write heads:** 16
- **Sectors per track:** 63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

<b>Interface</b>	SATA
<b>Recording method</b>	TGMR
<b>Recording density (kFCI)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
<b>Track density (ktracks/inch avg)</b>	352
<b>Areal density (Gb/in<sup>2</sup>)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
<b>Spindle speed (RPM)</b>	7200 ± 0.2%
<b>Internal data transfer rate (Mb/s max)</b>	2147
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
<b>Average data rate, read/write (MB/s)</b>	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
<b>I/O data-transfer rate (MB/s max)</b>	600

## 2.5 Physical characteristics

<b>Maximum height</b>	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB, 750GB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
<b>Maximum width (all models)</b>	101.6mm / 4.0 in (± 0.010 in)
<b>Maximum length (all models)</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB, 750GB, 500GB, 320GB and 250GB	415g / 0.915 lb
<b>Cache buffer</b>	
3TB, 2TB, 1.5TB	64MB (64,768kB)
1TB, 750GB	64MB (64,768kB) / 32MB (32,768kB)
500GB, 320GB and 250GB	32MB (32,768kB) / 16MB (16,384kB)

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

- Track-to-track seek time is an average of all possible single-track seeks in both directions.
- Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

### Note

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

	<b>3-disk</b> (3TB, 2TB models)	<b>2-disk</b> (2TB, 1.5TB models)	<b>1-disk</b> (1TB, 750GB models)	<b>1-disk</b> (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Powerspecifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to Figure 1 on page 23.

### 2.8.1 Powerconsumption

Power requirements for the drives are listed in Table 3, Table 4, Table 5 and Table 6. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

- **Spinup power**  
Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.
- **Read/write power and current**  
Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.
- **Operating power and current**  
Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.
- **Idle mode power**  
Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.
- **Standby mode**  
During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.



**Table 3 DC power requirements (3-disk: 3TB and 2TB models)**

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)**

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

**Table 5 DC power requirements (1-disk: 1TB and 750GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

**Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)**

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

## 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

- Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.
- Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

### Note

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

## 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

- 5V  $\pm 5\%$
- 12V +10% / -7.5%

## 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

- **Active mode**  
The drive is in Active mode during the read/write and seek operations.
- **Idle mode**  
The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.
- **Standby mode**  
The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.
- **Sleep mode**  
The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.
- **Idle and Standby timers**  
Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

## 2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.

**Note**

The maximum allowable drive case temperature is 69°C.  
See Figures 2 & 3 for HDA case temperature measurement locations.

Refer to [Section 3.4 Drive mounting](#) for base plate measurement location.

### 2.9.1 Ambient temperature

<b>Operating</b>	0° to 60°C (32° to 140°F)
<b>Non-operating</b>	–40° to 70°C (–40° to 158°F)

### 2.9.2 Temperature gradient

<b>Operating</b>	20°C per hour (68°F per hour max), without condensation
<b>Non-operating</b>	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

<b>Operating</b>	5% to 95% non-condensing (30% per hour max)
<b>Nonoperating</b>	5% to 95% non-condensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

<b>Operating</b>	26°C / 78.8°F (rated)
<b>Non-operating</b>	29°C / 84.2°F (rated)

### 2.9.4 Altitude

<b>Operating</b>	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
<b>Non-operating</b>	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

**Note**

Maximum storage condition not to exceed 90 days at a wetbulb temperature of 32°C (example: 34°C / 90%RH)

## 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

### 2.9.5.2 Non-operating shock

#### 3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

#### 1TB, 750GB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

### 2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

## 2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

## 2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note**

For seek mode tests, the drive is placed in seek mode only.  
The number of seeks per second is defined by the following equation:  
(Number of seeks per second =  $0.4 / (\text{average latency} + \text{average access time})$ )

**Table 7 Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	Seek
<b>3 Disks</b> (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
<b>2 Disks</b> (2TB, 1.5TB)		
<b>1 Disk</b> (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
<b>1 Disk</b> (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

### 2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in Table 8.

**Table 8 Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 Reliability

### 2.12.1 Annualized Failure Rate (AFR)

The production disk drive shall achieve an annualized failure-rate of <1.0% over a 5 year service life when used in Desktop Storage field conditions as limited by the following:

- 2400 power-on-hours per year.
- Typical workload

Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read, max
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> . From this page, click on the "Is my Drive under Warranty" link. The following are required to be provided: the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.
Preventive maintenance	None required.

### 2.12.2 Storage

Maximum storage periods are 180 days within original unopened Seagate shipping package or 60 days unpackaged within the defined non-operating limits (refer to environmental section in this manual). Storage can be extended to 1 year packaged or unpackaged under optimal environmental conditions (25°C, <40% relative humidity non-condensing, and non-corrosive environment). During any storage period the drive non-operational temperature, humidity, wet bulb, atmospheric conditions, shock, vibration, magnetic and electrical field specifications should be followed.

## 2.13 Agency certification

### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

**Korean RRL**

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

- Family name: Barracuda
- Certificate number: KCC-REM-STX-Barracuda

**Australian RCM Compliance Mark**

Models displayed with the RCM compliance mark, comply with the mandatory standards as per the Australian Communications and Media Authority (AMCA) Electromagnetic Compatibility (EMC) regulatory arrangement.

**2.13.3 FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

## 2.14 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

### 2.14.1 European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

### 2.14.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

## 2.15 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.



## 3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

#### Caution

- Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.
- Handle the drive by its edges or frame *only*.
- The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.
- Always rest the drive on a padded, antistatic surface until mounting it in the computer.
- Do not touch the connector pins or the printed circuit board.
- Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

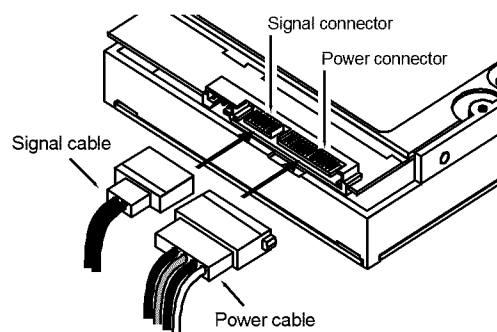
### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See [Table 9](#) for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in [Figure 1](#).

**Figure 1 Attaching SATA cabling**



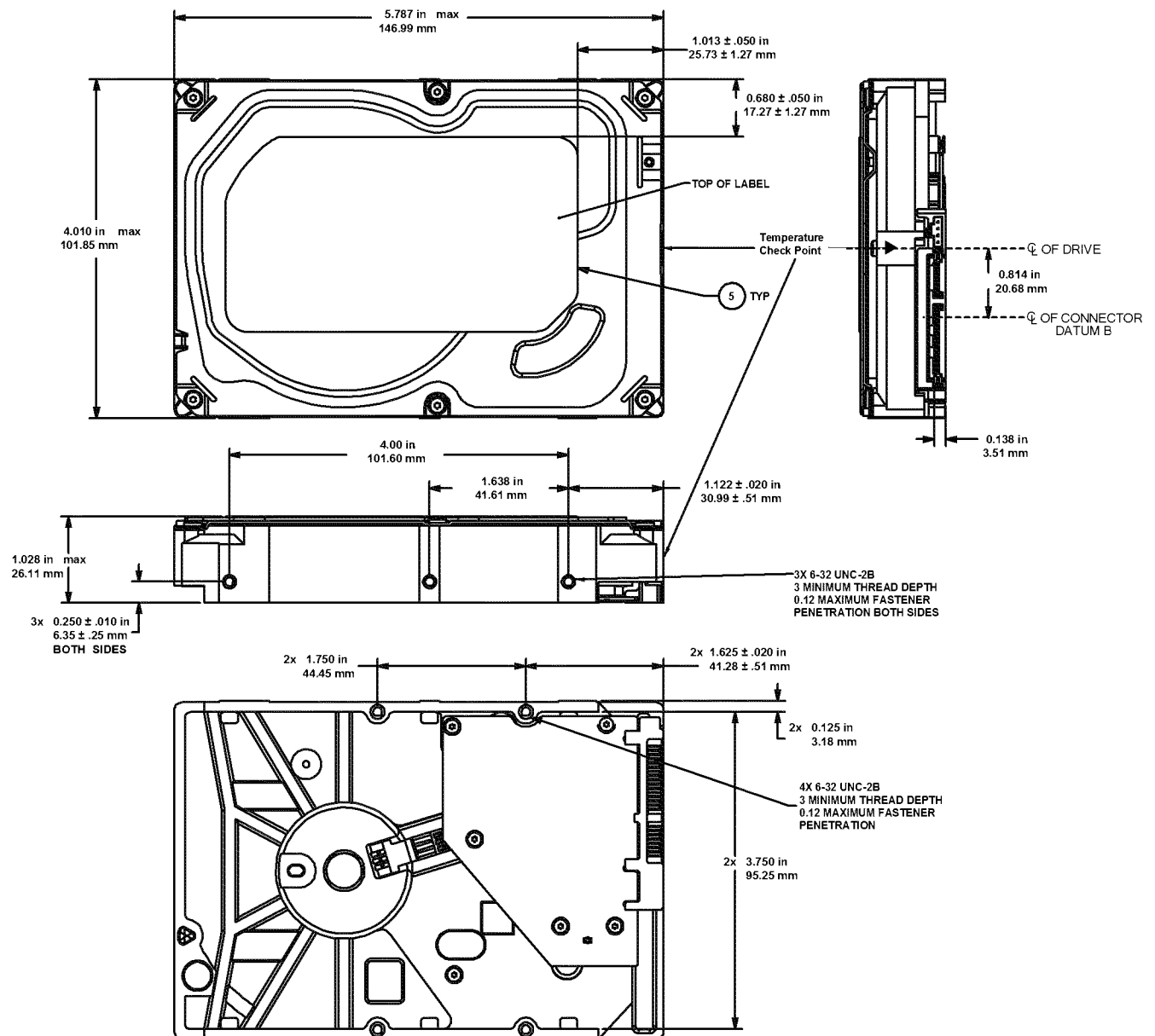
Each cable is keyed to ensure correct orientation. Desktop HDD drives support latching SATA connectors.

### 3.4 Drive mounting

Users can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2** and **Figure 3** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

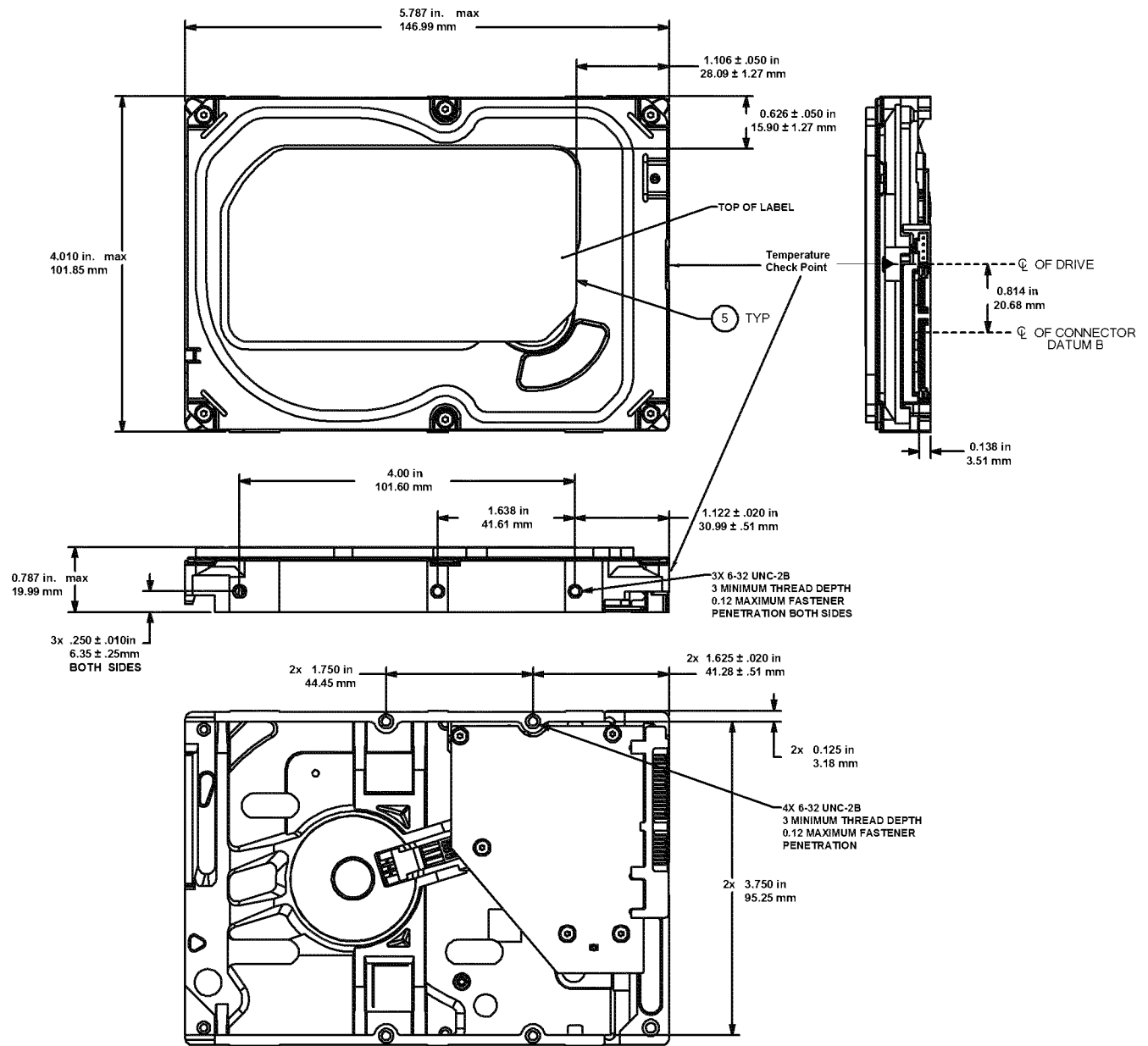
- Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.
- Use only 6-32 UNC mounting screws.
- The screws should be inserted no more than 0.120 inch (3.05mm) into the bottom or side mounting holes.
- Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2 Mounting dimensions (3-disk: 1.5TB to 3TB models)**



**Note**

Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.

**Figure 3 Mounting dimensions (1-disk: 250GB to 1TB models)****Note**

Drawings are for mounting hole reference only.  
PCBA show in pictorial only and can vary based on specific customer configurations.

## 4.0 About (SED) Self-Encrypting Drives

Self-encrypting drives (SEDs) offer encryption and security services for the protection of stored data, commonly known as "data at rest". These drives are compliant with the Trusted Computing Group (TCG) Opal Storage Specifications as detailed in the following:

- TCG Storage Architecture Core Specification, Version 2.0 (see [www.trustedcomputinggroup.org](http://www.trustedcomputinggroup.org))
- TCG Storage Security Subsystem Class Opal Specification, Version 2.0 (see [www.trustedcomputinggroup.org](http://www.trustedcomputinggroup.org))

In case of conflict between this document and any referenced document, this document takes precedence.

The Trusted Computing Group (TCG) is a standards organization sponsored and operated by companies in the computer, storage and digital communications industry. Seagate's SED models comply with the standards published by the TCG.

To use the security features in the drive, the host must be capable of constructing and issuing the following two SATA commands:

- Trusted Send
- Trusted Receive

These commands are used to convey the TCG protocol to and from the drive in their command payloads. Seagate Secure SEDs also support TCG Single User Mode, which can be disabled.

### 4.1 Data Encryption

Encrypting drives use one inline encryption engine within each drive employing AES-256 algorithms in Cipher Block Chaining (CBC) mode to encrypt all data prior to being written on the media and to decrypt all data as it is read from the media. The encryption engine is always in operation and cannot be disabled. The 32-byte Data Encryption Key (DEK) is a random number which is generated by the drive, never leaves the drive, and is inaccessible to the host system. The DEK is itself encrypted when it is stored on the media and when in volatile temporary storage (DRAM), which is external to the encryption engine. A unique data encryption key is used for each of the drive's possible 16 data bands (see [Section 4.5 Data Bands](#)).

### 4.2 Controlled Access

The drive has two security providers (SPs) called the "Admin SP" and the "Locking SP." These act as gatekeepers to the drive security services. Security-related commands will not be accepted unless the user provides the correct credentials to prove that they are authorized to perform the command.

#### 4.2.1 Admin SP

The Admin SP allows the drive's owner to enable or disable firmware download operations (see [Section 4.4 Drive Locking](#)). Access to the Admin SP is available using the SID (Secure ID) password.

#### 4.2.2 Locking SP

The Locking SP controls read/write access to the media and the cryptographic erase feature. Access to the Locking SP is available using the Admin or User passwords.

#### 4.2.3 Default password

When the drive is shipped from the factory, all passwords are set to the value of MSID. This 32-byte random value can only be read by the host electronically over the interface. After receipt of the drive, it is the responsibility of the owner to use the default MSID password as the authority to change all other passwords to unique owner-specified values.

#### 4.2.4 ATA Enhanced Security

The drive can utilize the system's BIOS through the ATASecurity API for cases that do not require password management and additional security policies.

Furthermore, the drive's ATASecurity Erase Unit command shall support both Normal and Enhanced Erase modes with the following modifications/additions:

**Normal Erase:** Normal erase feature shall be performed by changing the Data Encryption Key (DEK) of the drive, followed by an overwrite operation that repeatedly writes a single sector containing random data to the entire drive. This write operation bypasses the media encryption. On reading back the overwritten sectors, the host will receive a decrypted version, using the new DEK of the random data sector (the returned data will not match what was written).

**Enhanced Erase:** Enhanced erase shall be performed by changing the Data Encryption Key of the drive.

### 4.3 Random Number Generator (RNG)

The drive has a 32-byte hardware RNG that it uses to derive encryption keys or, if requested to do so, to provide random numbers to the host for system use, including using these numbers as Authentication Keys (passwords) for the drive's Admin and Locking SPs.

## 4.4 Drive Locking

In addition to changing the passwords, as described in [Section 4.2.3 Default password](#), the owner should also set the data access controls for the individual bands.

The variable "LockOnReset" should be set to "PowerCycle" to ensure that the data bands will be locked if power is lost. In addition "ReadLockEnabled" and "WriteLockEnabled" must be set to true in the locking table in order for the bands "LockOnReset" setting of "PowerCycle" to actually lock access to the band when a "PowerCycle" event occurs. This scenario occurs if the drive is removed from its cabinet. The drive will not honor any data read or write requests until the bands have been unlocked. This prevents the user data from being accessed without the appropriate credentials when the drive has been removed from its cabinet and installed in another system.

## 4.5 Data Bands

When shipped from the factory, the drive is configured with a single data band called Band 0 (also known as the Global Data Band) which comprises LBA 0 through LBA max. The host may allocate additional bands (Band1 to Band15) by specifying a start LBA and an LBA range. The real estate for this band is taken from the Global Band.

Data bands cannot overlap but they can be sequential with one band ending at LBA (x) and the next beginning at LBA (x+1).

Each data band has its own drive-generated encryption key. The host may change the Encryption Key (see [Section 4.6 Cryptographic Erase](#)) or the password when required.

## 4.6 Cryptographic Erase

A valuable feature of SEDs is the ability to perform a cryptographic erase. This involves the host telling the drive to change the data encryption key for a particular band. Once changed, the data is no longer recoverable since it was written with one key and will be read using a different key. Since the drive overwrites the old key with the new one, and keeps no history of key the older key, the user data can never be recovered. This is done in a matter of seconds and is very useful if the drive is to be scrapped or repurposed.

## 4.7 Authenticated Firmware Download

In addition to providing a locking mechanism to prevent unwanted firmware download attempts, the drive also only accepts download files which have been cryptographically signed by the appropriate Seagate Design Center.

Three conditions must be met before the drive will allow the download operation:

1. The download must be an SED file. A standard drive (non-SED) file will be rejected.
2. The download file must be signed and authenticated.
3. As with a non-SED drive, the download file must pass the acceptance criteria for the drive. For example it must be applicable to the correct drive model, and have compatible revision and customer status.

## 4.8 Power Requirements

The standard drive models and the SED drive models have identical hardware, however the security and encryption portion of the drive controller ASIC is enabled and functional in the SED models. This represents a small additional drain on the 5V supply of about

30mA and a commensurate increase of about 150mW in power consumption. There is no additional drain on the 12V supply. See the tables in [Section 2.8 Power specifications](#) for power requirements on the standard (non-SED) drive models.

## 4.9 Supported Commands

The SED models support the following two commands in addition to the commands supported by the standard (non-SED) models as listed in [Table 10](#):

- Trusted Send
- Trusted Receive

## 4.10 RevertSP

SED models will support the RevertSP feature which erases all data in all bands on the device and returns the contents of all SPs (Security Providers) on the device to their original factory state. In order to execute the RevertSP method the unique PSID (Physical Secure ID) printed on the drive label must be provided. PSID is not electronically accessible and can only be manually read from the drive label or scanned in via the 2D barcode.

## 5.0 SATAInterface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 5.1 Hot-Plug compatibility

Desktop HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 5.2 SATA device plug connector pin definitions

Table 9 summarizes the signals on the SATA interface and power connectors.

**Table 9 SATA connector pin definitions**

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
<b>Key and spacing separate signal and power segments</b>			
Power	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

#### Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
  - All used voltage pins (V<sub>x</sub>) must be terminated.

### 5.3 Supported ATAcommands

The following table lists SATAstandard commands that the drive supports.

For a detailed description of the ATAcommands, refer to the Serial ATAInternational Organization:

Serial ATARevision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 36 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 10 SATAstandard commands**

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>

**Table 10 SATA standard commands (continued)**

Command name	Command code (in hex)	
Security Freeze	F5 <sub>H</sub>	
Security Set Password	F1 <sub>H</sub>	
Security Unlock	F2 <sub>H</sub>	
Seek	70 <sub>H</sub>	
Set Features	EF <sub>H</sub>	
Set Max Address	F9 <sub>H</sub>	
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Address: Password: Lock: Unlock: Freeze Lock:	00 <sub>H</sub> 01 <sub>H</sub> 02 <sub>H</sub> 03 <sub>H</sub> 04 <sub>H</sub>
Set Max Address Extended	37 <sub>H</sub>	
Set Multiple Mode	C6 <sub>H</sub>	
Sleep	E6 <sub>H</sub>	
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>	
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>	
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>	
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>	
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>	
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>	
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>	
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>	
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>	
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>	
Standby	E2 <sub>H</sub>	
Standby Immediate	E0 <sub>H</sub>	
Write Buffer	E8 <sub>H</sub>	
Write DMA	CA <sub>H</sub>	
Write DMA Extended	35 <sub>H</sub>	
Write DMA FUA Extended	3D <sub>H</sub>	
Write DMA Without Retries	CB <sub>H</sub>	
Write Log Extended	3F <sub>H</sub>	
Write Multiple	C5 <sub>H</sub>	
Write Multiple Extended	39 <sub>H</sub>	
Write Multiple FUA Extended	CE <sub>H</sub>	
Write Sectors	30 <sub>H</sub>	
Write Sectors Without Retries	31 <sub>H</sub>	
Write Sectors Extended	34 <sub>H</sub>	
Write Uncorrectable	45 <sub>H</sub>	



### 5.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 29. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 11 Identify Device commands**

Word	Description	Value
0	Configuration information: <ul style="list-style-type: none"> <li>• Bit 15: 0 = ATA; 1 = ATAPI</li> <li>• Bit 7: removable media</li> <li>• Bit 6: removable controller</li> <li>• Bit 0: reserved</li> </ul>	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>

**Table 11 Identify Device commands (continued)**

Word	Description	Value
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>

**Table 11 Identify Device commands (continued)**

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFH.	ST3000DM001 = 5,860,533,168 ST3000DM002 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST2000DM002 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST1000DM004 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

**Note**

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

**Note**

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.

	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 5.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets **BSY**, checks the contents of the Features register, clears **BSY** and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 12 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note**

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 5.3.3 S.M.A.R.T.commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 13 S.M.A.R.T.commands**

Code in features register	S.M.A.R.T.command
D0 <sub>H</sub>	S.M.A.R.T.Read Data
D2 <sub>H</sub>	S.M.A.R.T.Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T.Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T.Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T.Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T.Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T.Enable Operations
D9 <sub>H</sub>	S.M.A.R.T.Disable Operations
DA <sub>H</sub>	S.M.A.R.T.Return Status

**Note**

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.



**Seagate Technology LLC**

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*Publication Number: 100686584, Rev.R (Draft 3)*

*February 2016*

# Exhibit 17





# Desktop HDD

Data Sheet

## The Power of One

- s SEAGATE BRINGS OVER 40 YEARS OF TRUSTED PERFORMANCE AND RELIABILITY TO THE NEWEST SEAGATE® DESKTOP (3.5" & 2.5" AVAILABLE IN CAPACITIES UP TO 14 TB)
- s DOUBLE YOUR CAPACITY AND DRIVE DOWN COSTS WITH THE INDUSTRY'S FIRST 4" PER DISK HARD DRIVE TECHNOLOGY
- s SATA 6 Gb/s INTERFACE OPTIMIZES BURST PERFORMANCE
- s SEAGATE POWERLAC® SERVO TECHNOLOGY DELIVERS DEPENDABLE PERFORMANCE, EVEN WITH HARD DRIVE TRACK WIDTHS OF ONLY 1.1 NANOMETERS
- s SEAGATE POWERLAC® TECHNOLOGY BOOSTS OVERALL PERFORMANCE BY AS MUCH AS 10% OVER THE PREVIOUS GENERATION
- s FREE SEAGATE SKILLZARD® SOFTWARE ALLOWS YOU TO INSTALL 4 TB HARD DRIVE IN 7 INCHES, INCLUDING 3.5" (WITHOUT 3.5" )/3.5"

## Best-Fit Applications

- s DESKTOP CRITICAL BUSINESS
- s HOME SERVERS
- s PC-BASED GAMING SYSTEMS
- s DESKTOP 2TB
- s DIRECT ATTACHED EXTERNAL STORAGE DEVICES 3.5"
- s NETWORK ATTACHED STORAGE DEVICES 3.5"



## Desktop HDD



Specifications	4TB <sup>1</sup>	3TB <sup>1</sup>	2TB <sup>1</sup>	1TB <sup>1</sup>	500GB <sup>1</sup>	320GB <sup>1</sup>	250GB <sup>1</sup>
Model Number	ST4000DM000	ST3000DM001	ST2000DM001	ST1000DM003	ST500DM002 <sup>2</sup>	ST320DM000 <sup>2</sup>	ST250DM000 <sup>2</sup>
Model Name	Desktop HDD	Barracuda®	Barracuda	Barracuda	Barracuda	Barracuda	Barracuda
Interface Options	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ
Performance							
Cache, Multisegmented (MB)	64	64	64	64	16	16	16
SATA Transfer Rates Supported (Gb/s)	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5
Seek Average, Read (ms)	<12	<8.5	<8.5	<8.5	<11	<11	<11
Seek Average, Write (ms)	<12	<9.5	<9.5	<9.5	<12	<12	<12
Average Data Rate, Read/Write (MB/s)	146	156	156	156	125	125	125
Max Sustained Data Rate, CD Read (MB/s)	180	210	210	210	144	144	144
Configuration/Organization							
Heads/Disks	8/4	6/3	6/3	2/1	2/1	2/1	1/1
Bytes per Sector	4096	4096	4096	4096	4096 or 512 <sup>2</sup>	4096 or 512 <sup>2</sup>	4096 or 512 <sup>2</sup>
Voltage							
Voltage Tolerance, Including Noise (5V)	+10%/–5.0%	+10%/–5.0%	+10%/–5.0%	+10%/–5.0%	+10%/–5.0%	+10%/–5.0%	+10%/–5.0%
Voltage Tolerance, Including Noise (12V)	+10%/–7.5%	+10%/–7.5%	+10%/–7.5%	+10%/–7.5%	+10%/–7.5%	+10%/–7.5%	+10%/–7.5%
Reliability/Data Integrity							
Contact Start/Stop Cycles	—	—	—	—	50,000	50,000	50,000
Load/Unload Cycles	300,000	300,000	300,000	300,000	—	—	—
Nonrecoverable Read Errors per Bits Read, Max	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14
Annualized Failure Rate (AFR)	<4%	<4%	<4%	<4%	<4%	<4%	<4%
Power-On Hours	2400	2400	2400	2400	2400	2400	2400
Power Management							
Startup Power (A)	2.0	2.5	2.5	2.0	2.0	2.0	2.0
Operating Mode, Typical (W)	7.5	8.0	8.0	5.90	6.19	6.19	6.19
Idle2 Average (W)	3.5	5.40	5.40	3.36	—	—	—
Idle Average (W)	1.5	—	—	—	4.60	4.60	4.60
Standby Mode (W)	0.50	0.75	0.75	0.63	0.79	0.79	0.79
Sleep Mode (W)	0.50	0.75	0.75	0.63	0.79	0.79	0.79
Environmental							
Temperature							
Operating (ambient min °C)	0	0	0	0	0	0	0
Operating (drive case max °C)	60	60	60	60	60	60	60
Nonoperating (ambient °C)	–40 to 75	–40 to 70	–40 to 70	–40 to 70	–40 to 70	–40 to 70	–40 to 70
Halogen Free	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RoHS Compliance	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Physical							
Height (mm/in)	26.11/1.028	26.11/1.028	26.11/1.028	20.17/0.7825	19.98/0.787	19.98/0.787	19.98/0.787
Width (mm/in)	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0
Depth (mm/in)	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787
Weight (g/lb)	650/1.43	626/1.38	626/1.38	450/0.99	415/0.92	415/0.92	415/0.92
Carton Unit Quantity	20	20	20	25	25	25	25
Cartons per Layer	40	40	40	40	40	40	40
Cartons per Pallet	8	8	8	8	8	8	8
Special Features							
Seagate OptiCache™ Technology	Yes	Yes	Yes	Yes	No	No	No
Seagate AcuTrac™ Technology	Yes	Yes	Yes	Yes	No	No	No

\*1 MB = ONE MEGABYTE OR "10<sup>6</sup>" EQUALS ONE MILLION BYTES AND ONE TERABYTE OR "10<sup>12</sup>" EQUALS ONE TRILLION BYTES WHEN REFERRING TO DRIVE CAPACITY.

3EAGATE SHIPSTHIS DRIVE IN BOTH Q + AND Q - !! BY TECTORS PART !! LION TECHNOLOGY IS INCLUDED ON Q + SECTOR DRIVES BOTH DRIVES ARE FUNCTIONAL AND PHYSICALLY EQUIVALENTS



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[illegible]

# Exhibit 18



# Desktop HDD

Data Sheet

## The Power of One

- Seagate brings over 30 years of trusted performance and reliability to the new Seagate® Desktop HDDs—now available in capacities up to 4TB.
- Double your capacity and drive down costs with up to 1TB-per-disk hard drive technology.
- SATA 6Gb/s interface optimizes burst performance
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45%.
- Free Seagate DiskWizard™ software allows you to install 3TB and 4TB hard drives in Windows, including XP, without UEFI BIOS.

## Best-Fit Applications

- Desktop or all-in-one PCs
- Home servers
- PC-based gaming systems
- Desktop RAID
- Direct-attached external storage devices (DAS)
- Network-attached storage devices (NAS)



## Desktop HDD



Specifications	4TB <sup>1</sup>	3TB <sup>1</sup>	2TB <sup>1</sup>	1TB <sup>1</sup>	500GB <sup>1</sup>	320GB <sup>1</sup>	250GB <sup>1</sup>
Model Number	ST4000DM000	ST3000DM001	ST2000DM001	ST1000DM003	ST500DM002 <sup>2</sup>	ST320DM000 <sup>2</sup>	ST250DM000 <sup>2</sup>
Model Name	Desktop HDD	formerly Barracuda®	formerly Barracuda	formerly Barracuda	formerly Barracuda	formerly Barracuda	formerly Barracuda
Interface Options	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ	SATA 6Gb/s NCQ
Performance							
Cache, Multisegmented (MB)	64	64	64	64	16	16	16
SATA Transfer Rates Supported (Gb/s)	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5
Seek Average, Read (ms)	<8.5	<8.5	<8.5	<8.5	<11	<11	<11
Seek Average, Write (ms)	<9.5	<9.5	<9.5	<9.5	<12	<12	<12
Average Data Rate, Read/Write (MB/s)	146	156	156	156	125	125	125
Max Sustained Data Rate, CD Read (MB/s)	180	210	210	210	144	144	144
Configuration/Organization							
Heads/Disks	8/4	6/3	6/3	2/1	2/1	2/1	1/1
Bytes per Sector	4096	4096	4096	4096	4096 or 512 <sup>2</sup>	4096 or 512 <sup>2</sup>	4096 or 512 <sup>2</sup>
Voltage							
Voltage Tolerance, Including Noise (5V)	±5%	±5%	±5%	±5%	±5%	±5%	±5%
Voltage Tolerance, Including Noise (12V)	±10%	+10%/–7.5%	+10%/–7.5%	+10%/–7.5%	+10%/–7.5%	+10%/–7.5%	+10%/–7.5%
Reliability/Data Integrity							
Contact Start/Stop Cycles	—	—	—	—	50,000	50,000	50,000
Load/Unload Cycles	300,000	300,000	300,000	300,000	—	—	—
Nonrecoverable Read Errors per Bits Read, Max	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14
Power-On Hours	2400	2400	2400	2400	2400	2400	2400
Power Management							
Startup Power (A)	2.0	2.5	2.5	2.0	2.0	2.0	2.0
Operating Mode, Typical (W)	7.5	8.0	8.0	5.90	6.19	6.19	6.19
Idle Average (W)	5.0	5.8	5.8	4.0	4.60	4.60	4.60
Standby Mode (W)	0.75	0.75	0.75	0.63	0.79	0.79	0.79
Sleep Mode (W)	0.75	0.75	0.75	0.63	0.79	0.79	0.79
Environmental							
Temperature							
Operating (ambient min °C)	0	0	0	0	0	0	0
Operating (drive case max °C)	60	60	60	60	60	60	60
Nonoperating (ambient °C)	–40 to 70	–40 to 70	–40 to 70	–40 to 70	–40 to 70	–40 to 70	–40 to 70
Halogen Free	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RoHS Compliance	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Physical							
Height (mm/in)	26.11/1.028	26.11/1.028	26.11/1.028	20.17/0.7825	19.98/0.787	19.98/0.787	19.98/0.787
Width (mm/in)	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0
Depth (mm/in)	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787
Weight (g/lb)	610/1.345	626/1.38	626/1.38	400/0.88	415/0.92	415/0.92	415/0.92
Carton Unit Quantity	20	20	20	25	25	25	25
Cartons per Pallet	40	40	40	40	40	40	40
Cartons per Layer	8	8	8	8	8	8	8
Special Features							
Seagate OptiCache™ Technology	Yes	Yes	Yes	Yes	No	No	No
Seagate AcuTrac™ Technology	Yes	Yes	Yes	Yes	No	No	No

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Seagate ships this drive in both 4K- and 512-byte sectors. SmartAlign technology is included on 4K sector drives. Both drives are functionally and physically equivalent.



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# Exhibit 19





# STORAGE SOLUTIONS GUIDE

OCTOBER 2010 | AMER





# FreeAgent GoFlex™

ULTRA-PORTABLE DRIVE



## PROTECT. STORE. DO MORE.



## Choose the Best Storage Solution.

This guide offers up-to-date details and specifications for all Seagate® products. From the world's fastest, largest-capacity desktop drives to external storage solutions that allow you to access your files anytime, anywhere.

[seagate.com](http://seagate.com)

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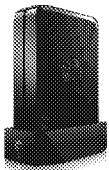

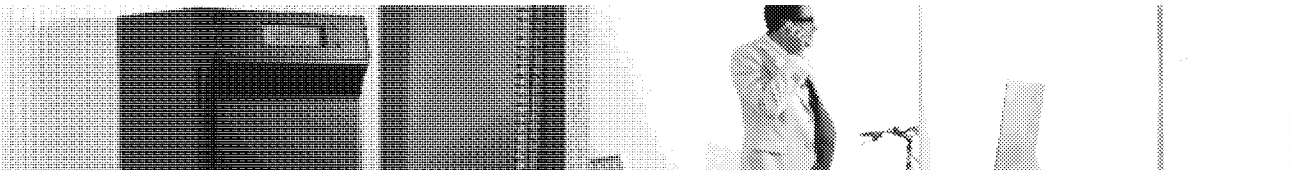
# EXTERNAL STORAGE SOLUTIONS

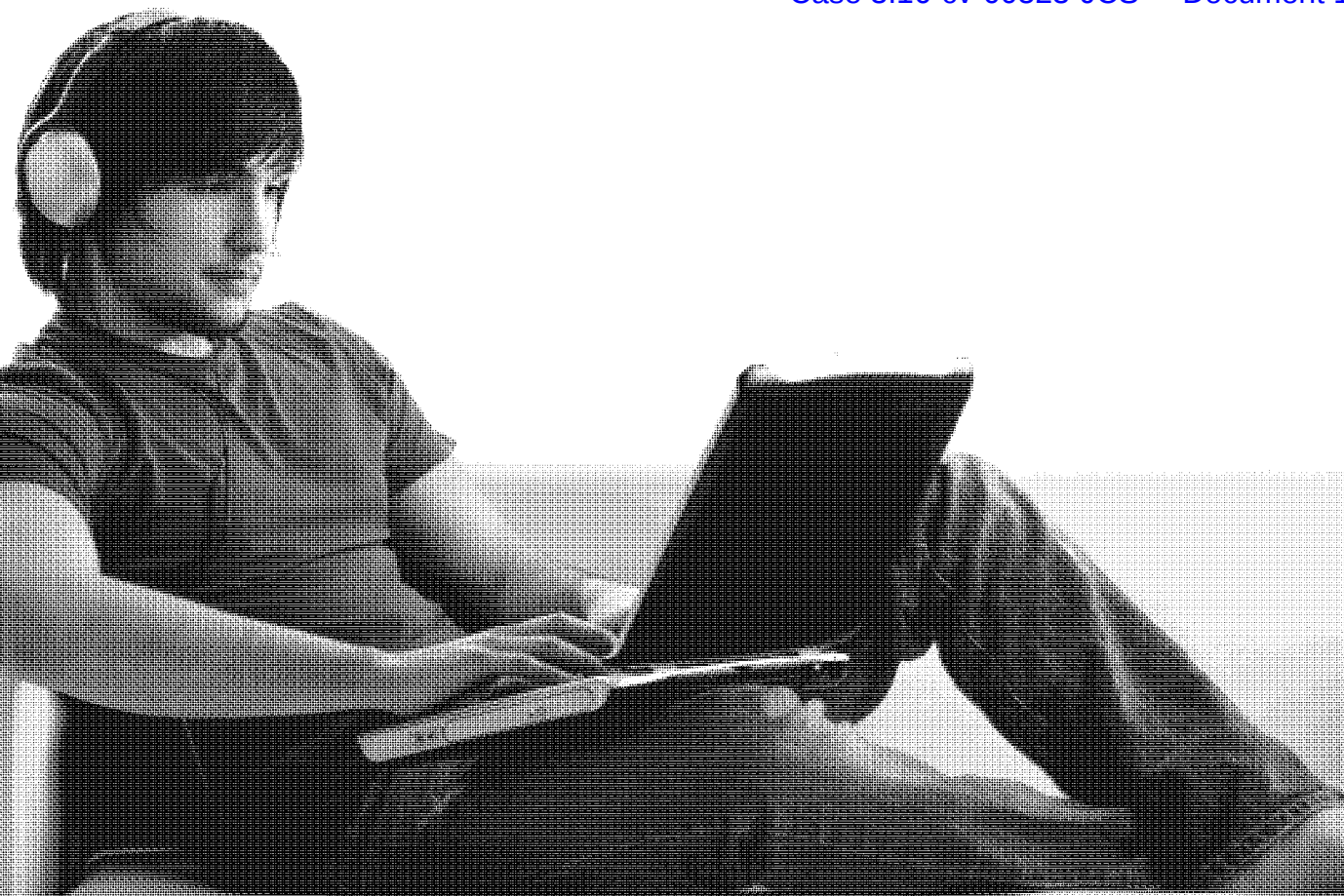
## At-a-Glance Product Comparison



	SEAGATE FREEAGENT™			SEAGATE EXPANSION™	
Direct Attached/ Portable					
	FreeAgent GoFlex™	FreeAgent GoFlex Pro	FreeAgent GoFlex Desk	Expansion External	Expansion Portable
Perfect For	Compact storage on the go		Satisfying high-capacity cravings	Plug-and-play add-on desktop storage	Plug-and-play add-on desktop storage
Description	These ultra-portable, ultra-upgradable drives make it easy to store and protect all your files, automatically and continuously. PC or Mac.		Store and protect all your photos, music, videos and documents with this powerful, high-capacity desktop storage solution. PC or Mac.	Instant add-on storage for your ever-growing collection of files lets you free space on your internal drive. PC or Mac.	
Compatible with Windows 7	X	X	X	X	
Learn More	Page 5	Page 6	Page 6	Page 9	Page 9

	SEAGATE FREEAGENT
Home Entertainment	
	FreeAgent GoFlex TV
<b>Perfect For</b>	Getting the most from your digital media
<b>Description</b>	Enjoy all of your movies, music and photos on your TV, in full 1080p HD with vibrant surround sound. PC or Mac.
<b>Compatible with Windows 7</b>	
<b>Learn More</b>	Page 8

SEAGATE FREEAGENT			SEAGATE BLACKARMOR®						
Network Attached									
	FreeAgent GoFlex Home		FreeAgent GoFlex Net		BlackArmor NAS 440	BlackArmor NAS 420	BlackArmor NAS 400	BlackArmor NAS 220	BlackArmor NAS 110
Perfect For	Wireless centralized home storage		Easy access from anywhere		Full-system backup, RAID 0, 1, 5, 10 or JBOD			Full-system backup, RAID 0 or 1	Full-system backup
Description	This network storage system supports the external storage needs of every computer in your home. PC or Mac.		Dock up to two GoFlex ultra-portable drives and one USB storage device on this media sharing device. PC or Mac.		A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations			A network attached storage solution designed to provide centralized storage and data backup. BlackArmor NAS 110 enables media streaming.	
Compatible with Windows 7	X		X						
Learn More	Page 7		Page 7		Page 10	Page 10	Page 10	Page 11	Page 11



# EXTERNAL STORAGE SOLUTIONS

Seagate external storage solutions are sleek, sophisticated products that let your customers easily store digital family photos, protect critical business data, back up multiple computers on a small network, or store and share videos and music.

## FreeAgent GoFlex™ ULTRA-PORTABLE DRIVE

The GoFlex ultra-portable drive makes it easy to store and protect all your files, automatically and continuously.

### Key Advantages

- Plug and play interface
- Preloaded backup software with encryption
- USB 3.0, FireWire 800 or powered eSATA for fast transfers
- Access and share files from anywhere.
- View your movies and photos on your TV.
- 2-year limited warranty

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Carry files while on the go.
- Access files with both PC and Mac computers.



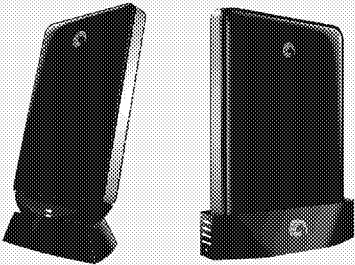
CAPACITY <sup>1</sup>	KIT NUMBER	INTERFACE	COLOR	OS	
1.5TB	STAA1500100	USB 3.0	● Black	PC, Mac	
1TB	STAA1000100	USB 2.0	● Black	PC, Mac	
1TB	STAA1000101	USB 3.0	● Black	PC, Mac	NEW
1TB	STAA1000102	USB 3.0	● Blue	PC, Mac	
750GB	STAA750100	USB 2.0	● Black	PC, Mac	
750GB	STAA750101	USB 3.0	● Black	PC, Mac	NEW
500GB	STAA500105	USB 2.0	● Black	PC, Mac	NEW
500GB	STAA500106	USB 2.0	● Silver	PC, Mac	NEW
500GB	STAA500107	USB 2.0	● Blue	PC, Mac	NEW
500GB	STAA500108	USB 2.0	● Red	PC, Mac	NEW
PRODUCT DIMENSIONS (1.5TB, 1TB, 750GB)		4.71-in L x 3.51-in W x 0.87-in D (120mm x 89mm x 22mm)			
PRODUCT DIMENSIONS (500GB)		4.33-in L x 3.27-in W x 0.59-in D (110mm x 83mm x 15mm)			
PACKAGE DIMENSIONS		5.20-in L x 1.73-in W x 6.54-in D (132mm x 44mm x 166mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown



# FreeAgent® GoFlex™ Pro

The GoFlex Pro ultra-portable drive delivers premium backup and encryption, which automatically and continuously protects all your files.



## Key Advantages

- Plug-and-play interface
- Preloaded backup software with encryption
- Upgrade to USB 3.0, FireWire 800 or powered eSATA or access content over the network and on TV.
- Includes desktop dock
- 3-year limited warranty

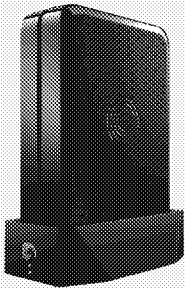
## Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Carry files while on the go.
- Access files with both PC and Mac computers.

CAPACITY	KIT NUMBER	INTERFACE	OS	
750GB	STAD750102 <sup>3</sup>	USB 3.0	PC, Mac	NEW
750GB	STAD750101 <sup>3</sup>	USB 2.0	PC, Mac	NEW
750GB	STAD750100 <sup>4</sup>	USB 2.0	PC, Mac	
500GB	STAD500102 <sup>3</sup>	USB 3.0	PC, Mac	NEW
500GB	STAD500101 <sup>3</sup>	USB 2.0	PC, Mac	NEW
500GB	STAD500100 <sup>4</sup>	USB 2.0	PC, Mac	
DRIVE DIMENSIONS	4.14-in L x 3.23-in W x 0.55-in D (112mm x 82mm x 14mm)			
PACKAGE DIMENSIONS	6.10-in L x 4.69-in W x 1.73-in D (170mm x 160mm x 45mm)			

# FreeAgent® GoFlex™ Home

The GoFlex Home network storage system allows you to wirelessly store and access files and back up multiple computers in the home.



## Key Advantages

- Connects to your WiFi router
- Simple setup in just minutes
- Automatic and continuous backup
- Easily update storage capacity or plug in external drives—no tools required.

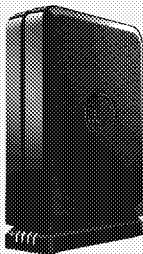
## Best-Fit Applications

- Back up multiple home PC and Mac computers.
- Store files in a central location.
- Access files from computers and mobile devices over the Internet.
- Stream media to game consoles and media players.
- Share a USB printer with all computers in the home.

CAPACITY	KIT NUMBER	INTERFACE	OS	
3TB	STAM3000100	SATA/GigE	PC, Mac	NEW
2TB	STAM2000100	SATA/GigE	PC, Mac	
1TB	STAM1000100	SATA/GigE	PC, Mac	
PRODUCT DIMENSIONS	3.13-in L x 5.31-in W x 6.75-in D (80mm x 135mm x 171mm)			
PACKAGE DIMENSIONS	10.04-in L x 3.07-in W x 7.64-in D (255mm x 78mm x 194mm)			

# FreeAgent® GoFlex™ Desk

The GoFlex Desk external drive delivers high-capacity storage and automatic, continuous backup and encryption with its preloaded software.



## Key Advantages

- Plug-and-play interface
- Preloaded premium backup software with encryption
- USB 2.0 adapter with capacity gauge display
- Upgrade to a faster interface with a GoFlex Desk adapter.
- Offers both vertical and horizontal drive orientation
- 2-year limited warranty

## Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Access files with both PC and Mac computers.

CAPACITY	KIT NUMBER	INTERFACE	OS	
3TB	STAC3000100	USB 2.0	PC, Mac	
3TB	STAC3000101	USB 3.0	PC, Mac	NEW
2TB	STAC2000100	USB 2.0	PC, Mac	
2TB	STAC2000103	USB 3.0	PC, Mac	NEW
1TB	STAC1000100	USB 2.0	PC, Mac	
1TB	STAC1000101	USB 3.0	PC, Mac	NEW
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

# FreeAgent® GoFlex™ Net

The FreeAgent GoFlex Net media sharing device allows you to access and share your digital life with anyone, anywhere.



## Key Advantages

- Dock up to two GoFlex ultra-portable drives and one USB storage device.
- Automatically sync content from a folder on your computer with a GoFlex Net folder.
- Sync content between two attached drives.
- Drag-and-drop access from the home or Internet
- No subscription fees

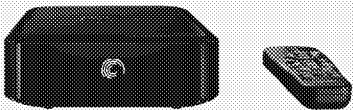
## Best-Fit Applications

- Access files from any networked home PC or Mac.
- Access and share files with friends over the Internet.
- Stream photos, movies and music to your GoFlex TV HD media player or compatible game consoles.
- Wirelessly access photos, movies and music from your iPad, iPhone, Blackberry or Android device.

CAPACITY	KIT NUMBER	INTERFACE	OS
—	STAK100	SATA/GigE	PC, Mac
PRODUCT DIMENSIONS	4.72-in L x 3.74-in W x 1.44-in D (120mm x 95mm x 36.5mm)		
PACKAGE DIMENSIONS	6.57-in L x 5.24-in W x 2.64-in D (167mm x 133mm x 67mm)		

FreeAgent® GoFlex™ TV

The FreeAgent GoFlex TV HD media player offers the easiest way to play your movies, photos and music on your TV.



Key Advantages

- Connects to your router to access Internet content and shared media on your home network
- Play media from GoFlex ultra-portable drives or any USB storage device.
- HDMI connectivity and 1080p HD video playback
- Supports most major codec and file formats

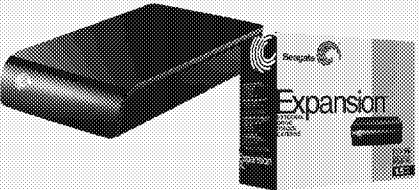
Best-Fit Applications

- Enjoy your movies, photos and music on your TV.
- Play your HD movie collection on your big screen.
- Access content from home network storage devices.
- Access Internet content on your TV.
- Stream movies from Netflix (subscription required).

CAPACITY	KIT NUMBER	INTERFACE	OS
—	STAJ100	SATA/AV	PC, Mac
PRODUCT DIMENSIONS	4.30-in L x 5.91-in W x 1.65-in D (110mm x 150mm x 42mm)		
PACKAGE DIMENSIONS	9.06-in L x 7.88-in W x 3.54-in D (230mm x 200mm x 90mm)		

Expansion™ External

Seagate external desktop drives provide instant add-on storage for your ever-growing collection of files.



Key Advantages

- Plug-and-play, no software to install
- Simply drag and drop to save files.
- Built-in power management ensures energy-efficient operation

Best-Fit Applications

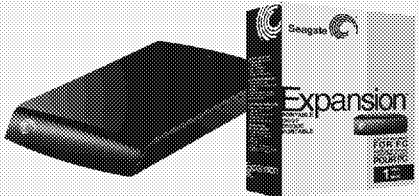
- Instantly add more storage space to your computer.
- Free space on your internal hard drive to increase computer performance.
- Consolidate all your files to a single location.

CAPACITY	KIT NUMBER	INTERFACE	OS
2TB	ST320005EXA101-RK	USB 2.0	PC, Mac
1.5TB	ST315005EXA101-RK	USB 2.0	PC, Mac
1TB	ST310005EXA101-RK	USB 2.0	PC, Mac
500GB	ST305005EXA101-RK	USB 2.0	PC, Mac
PRODUCT DIMENSIONS	4.96-in W x 1.57-in H x 8.15-in D (125.98mm x 39.88mm x 207.08mm)		
PACKAGE DIMENSIONS	9.69-in W x 8.62-in H x 3.07-in D (246.12mm x 218.95mm x 77.97mm)		



Expansion™ Portable

Portable add-on storage lets you free space on your internal drive and take large files on the go.



Key Advantages

- Plug-and-play, no software to install
- Simply drag and drop to save files.
- Built-in power management ensures energy-efficient operation

Best-Fit Applications

- Instantly add more storage space to your computer.
- Take large files with you when you travel.

CAPACITY	KIT NUMBER	INTERFACE	OS
1.5TB	STAX1500100	USB 2.0	PC, Mac
1TB	ST910004EXA101-RK	USB 2.0	PC, Mac
750GB	ST907504EXA101-RK	USB 2.0	PC, Mac
500GB	ST905004EXA101-RK	USB 2.0	PC, Mac
320GB	ST903204EXA101-RK	USB 2.0	PC, Mac
250GB	ST902504EXA101-RK	USB 2.0	PC, Mac
PRODUCT DIMENSIONS	3.15-in W x 0.69-in H x 5.56-in D (80.01mm x 17.60mm x 141.29mm)		
PACKAGE DIMENSIONS	5.20-in W x 6.85-in H x 2.20-in D (132.08mm x 173.99mm x 55.88mm)		





BlackArmor® NAS 440/420/400

A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations

Key Advantages

- BlackArmor NAS 440 models include four drives to increase capacity and take advantage of RAID 5/10 options.
- BlackArmor NAS 420 model provides an entry-level option—two drives included, two additional bays for business growth.
- BlackArmor NAS 400 model available without pre-installed drives for maximum flexibility.
- Designed for small business to provide optimum uptime and data integrity
- User-configurable RAID 0/1/5/10 and JBOD
- Continuous and automatic full-system backup for network connected workstations\*
- Hot-swappable, user-serviceable drives—no tools required

Best-Fit Applications

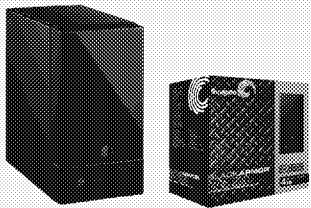
- Store and access files from a central, secure location.
- Access and manage files remotely.
- Back up or move files to a secondary storage device.
- Automatically perform full-system backups on network-connect PCs.
- Share a USB printer with network-connected PCs and Macs.
- Encrypt individual files to entire volumes of data.
- Stream media with DLNA or iTunes.

\* Includes 10 software licenses, additional licenses available at seagate.com

CAPACITY <sup>1</sup>	KIT NUMBER	INTERFACE	OS	
12TB	STAU12000100	Ethernet 10/100/1000	PC, Mac	NEW
8TB	ST380005SHA10G-RK	Ethernet 10/100/1000	PC, Mac	
4TB	ST340005SHA10G-RK	Ethernet 10/100/1000	PC, Mac	
4TB	STAH4000100	Ethernet 10/100/1000	PC, Mac	
2TB	ST320005SHA10G-RK	Ethernet 10/100/1000	PC, Mac	
—	STAR401	Ethernet 10/100/1000	PC, Mac	NEW
PRODUCT DIMENSIONS	6.30-in W x 8.15-in H x 10.59-in D (160.00mm x 207.00mm x 269.00mm)			
PACKAGE DIMENSIONS	9.29-in W x 9.50-in H x 14.37-in D (236.00mm x 241.30mm x 365.00mm)			

BlackArmor® NAS 220

A small-business-specific network attached storage solution designed for centralized storage and data backup for up to 20 PCs



Key Advantages

- Automatic data mirroring with RAID 1
- Protect network-connected PCs with incremental and full-system, automatic backup.\*
- Functions as FTP server for remote access
- Includes two reliable, user-replaceable drives
- Secure files with hardware-based encryption.

Best-Fit Applications

- Central, secure file storage and access
- Access and manage files remotely.
- Share a printer with connected PCs and Macs.

\* Includes 10 software licenses, additional licenses available at seagate.com

CAPACITY <sup>1</sup>	KIT NUMBER	INTERFACE	OS
4TB	ST340005LSA10G-RK	Ethernet 10/100/1000	PC, Mac
2TB	ST320005LSA10G-RK	Ethernet 10/100/1000	PC, Mac
PRODUCT DIMENSIONS	4.09-in W x 7.79-in H x 7.40-in D (104.00mm x 197.80mm x 188.00mm)		
PACKAGE DIMENSIONS	10.90-in W x 6.13-in H x 11.00-in D (276.86mm x 155.70mm x 279.40mm)		

BlackArmor® NAS 110

A network attached storage solution designed to provide centralized storage, data backup and media streaming for up to 10 PCs



Key Advantages

- Automatic full-system backup for network-connected PCs.\*
- Powerful hardware-based encryption
- Functions as an FTP server for remote file access
- DLNA and iTunes media streaming
- Two USB ports for external drives, printers and UPS

Best-Fit Applications

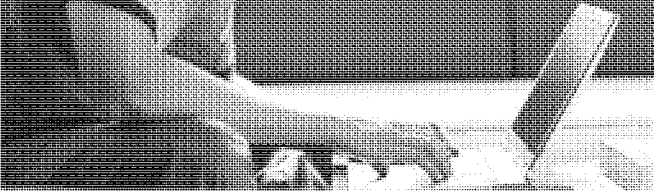
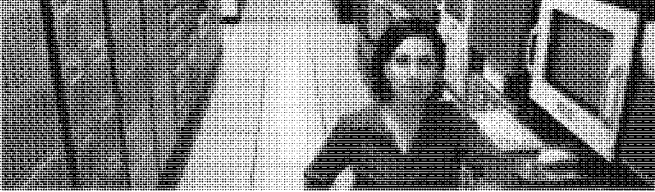
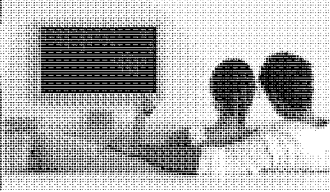
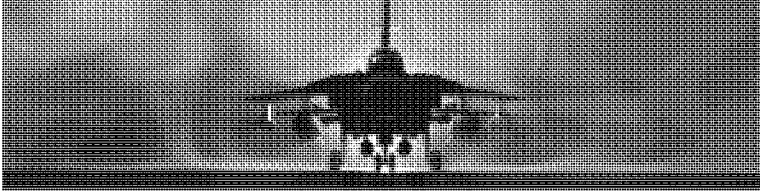
- Central, secure file storage and access
- Access and manage files remotely.
- Share a printer with connected PCs and Macs.

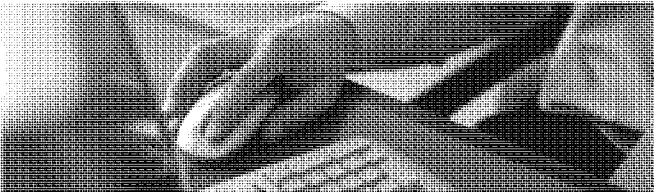
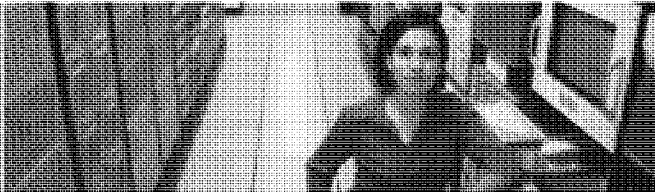
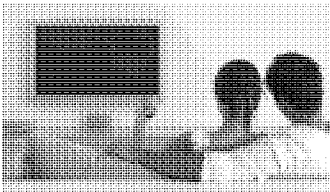
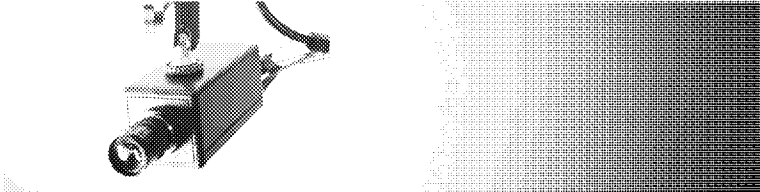
\* Includes 10 software licenses, additional licenses available at seagate.com

CAPACITY <sup>1</sup>	KIT NUMBER	INTERFACE	OS
2TB	ST320005MNA10G-RK	Ethernet 10/100/1000	PC, Mac
1TB	ST310005MNA10G-RK	Ethernet 10/100/1000	PC, Mac
PRODUCT DIMENSIONS	5.51-in L x 2.38-in W x 6.93-in H (150mm x 60mm x 176mm)		
PACKAGE DIMENSIONS	9.29-in L x 3.66-in W x 9.02-in H (236mm x 93mm x 229mm)		

# INTERNAL STORAGE SOLUTIONS

## At-a-Glance Product Comparison

	LAPTOP			ENTERPRISE			DVR	RUGGED AND EXTREME	
2.5-inch									
	MOMENTUS® XT	MOMENTUS	MOMENTUS THIN	SAVVIO® 15K	SAVVIO 10K	CONSTELLATION®	PIPELINE HD® MINI	EE25 SERIES™ EXTREME	EE25 SERIES RUGGED
Business Need	Extreme Performance	Mainstream	Slim Computing	Performance	Mainstream	Low Power	Mainstream	Extreme and Rugged	
Use This Drive For	The ultimate mobile computing experience, with SSD-like performance for all applications and OS environments	Laptop PCs where the lowest power consumption, silent acoustics and the highest quality is always expected. Encryption models available	Slim computing devices such as thin laptops and netbooks, where z-height makes all the difference	Compute-intensive data requirements demanding the highest performance density and availability. Encryption models available	Mainstream data requiring high capacity, performance density and reliability. Encryption models available	Online reference data demands requiring cost-effective, low-power, enterprise-class drives. Encryption models available	Small form factor DVR applications where video streaming, power and acoustic performance are key	Full automotive-class storage operating from -30°C to +85°C	Rugged or industrial storage requirements operating from -20°C to +75°C
Learn More	Page 20	Page 21	Page 22	Page 26	Page 26	Page 28	Page 32	Page 33	Page 33

	DESKTOP			ENTERPRISE			DVR	SURVEILLANCE		
3.5-inch										
	BARRACUDA® XT	BARRACUDA	BARRACUDA LP	CHEETAH® 15K	CHEETAH NS	CONSTELLATION ES	PIPELINE HD	SV35 SERIES™	PIPELINE HD	CONSTELLATION ES
Business Need	Performance	Mainstream	Low Power	Performance	Low Power	Capacity	Mainstream	Performance	Mainstream	Centralized
Use This Drive For	High-performance PC and workstations where big cache, maximum capacities and top-end performance are priorities	Mainstream desktop compute where choice in capacity and cache options to provide design flexibility is important	Lower-power applications where power conservation with good performance is required	High-capacity, compute-intensive requirements demanding high performance and availability. Encryption models available	Mainstream data requiring high capacity, low power and high availability. Encryption models available	Maximum-capacity enterprise servers and storage arrays requiring enterprise-class reliability. Encryption models available	DVR systems where reliable, low-power, purpose-built storage is required for video streaming applications	Surveillance systems that require high-performance, low-power, ruggedized and centralized storage for every surveillance application		
Learn More	Page 16	Page 16	Page 17	Page 27	Page 27	Page 28	Page 32	Page 33	Page 32	Page 28

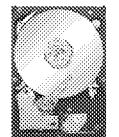


## Product Comparison



	BARRACUDA® 3.5-INCH INTERNAL KIT	BARRACUDA
Application	Mainstream	Mainstream and Performance
Description	The fast, powerful and easy way to upgrade or add storage capacity to desktop computers	Tuned performance for low-power, mainstream and high-performance desktop computing
Form Factor	3.5 inch	3.5 inch
Performance	5900 RPM to 7200 RPM	5900 RPM to 7200 RPM
Reliability (AFR)	0.34%	0.34%
Max. Ext. Transfer Rate	300MB/s	300MB/s to 600MB/s
Capacity <sup>1</sup>	500GB to 2TB	160GB to 2TB
Interface	SATA 3Gb/s	SATA 3Gb/s
Cache	16MB to 32MB	8MB to 64MB
Power (Idle)		3.0W to 8.3W

## Feature Comparison



	Mainstream	Mainstream and Performance		Performance
Product	Barracuda 3.5-Inch Internal Kit	Barracuda LP	Barracuda	Barracuda XT
SATA Interface	X	X	X	X
Low Power		X		
Sustainable Technology	X	X	X	X
Best-in-Class Performance		X	X	X
Capacity Leadership	X	X	X	X
Quiet Acoustics	X	X		
DiscWizard™ Installation Software	X			
Compatible with Windows 7 <sup>2</sup>	X	X	Barracuda 7200.12 Barracuda 7200.11	X

DESKTOP  
STORAGE

Seagate has a history of leadership in desktop drives, delivering innovative technologies, super-sized capacities, low power and blazing fast performance. Seagate desktop drives offer excellent performance at all levels.

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 7, visit: <http://www.seagate.com/seagate/compatibility/windows-7/en-us/Search.aspx?type=Hardware&se=seagate>

# Barracuda® XT

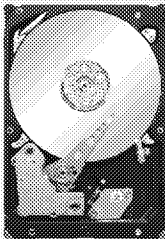
The Seagate Barracuda XT drive does not compromise, bringing both speed and capacity to high-performance desktop systems.

### Key Advantages

- Massive capacity for space-hungry games or video
- Top-end, 7200-RPM desktop performance
- Large cache optimizes performance and reduces bottlenecks.
- SATA 6Gb/s interface enables use of newest, fastest controllers.

### Best-Fit Applications

- High-performance PC gaming systems
- High-definition video editing and production systems
- Home servers and workstations
- Desktop RAID
- FireWire 800- or eSATA-enabled external storage devices



CAPACITY¹	MODEL	INTERFACE	CACHE
2TB	ST32000641AS	SATA 6Gb/s NCQ	64MB

# Barracuda® LP

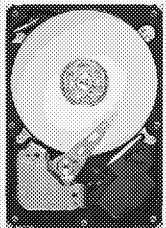
The Seagate Barracuda LP drive is the low-power, 3.5-inch drive that won't slow you down.

### Key Advantages

- Consumes up to 44% less power than standard drives
- Best-in-class acoustics mean quiet operation.
- Cool, low-power drives can reduce system costs.
- Sustainable green technology:
  - 70% or more of build materials can be recycled.
  - Complies with the RoHS directive and several non-regulatory restrictions
  - Built to international environmental standards

### Best-Fit Applications

- Personal attached storage—USB/FireWire/eSATA
- Small office and home data storage appliances
- Low-power PCs



CAPACITY¹	MODEL	INTERFACE	CACHE
2TB	ST32000542AS	SATA 3Gb/s	32MB
1.5TB	ST31500541AS	SATA 3Gb/s	32MB
1TB	ST31000520AS	SATA 3Gb/s	32MB

# Barracuda®

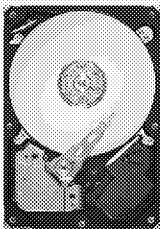
The Seagate Barracuda drive combines proven technology with expert manufacturing to deliver up to 1.5TB of reliable desktop storage.

### Key Advantages

- Broad range of capacities
- Most reliable and proven PMR technology
- Benchmark-winning performance
- Meets strict RoHS requirements
- Sustainable green technology

### Best-Fit Applications

- Workstations
- Desktop RAID
- Gamer PCs
- High-end PCs
- Mainstream PCs



CAPACITY¹	MODEL	INTERFACE	CACHE
1.5TB	ST31500341AS	SATA 3Gb/s NCQ	32MB
1TB	ST31000528AS	SATA 3Gb/s NCQ	32MB
750GB	ST3750528AS	SATA 3Gb/s NCQ	32MB
500GB	ST3500418AS	SATA 3Gb/s NCQ	16MB
320GB	ST3320418AS	SATA 3Gb/s NCQ	16MB
250GB	ST3250318AS	SATA 3Gb/s NCQ	8MB
160GB	ST3160318AS	SATA 3Gb/s NCQ	8MB

# Barracuda® 3.5-Inch Internal

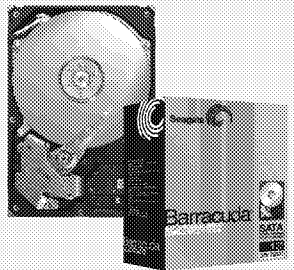
Seagate 3.5-inch internal drives are the fast, powerful, and easy way to upgrade or add storage capacity to desktop computers.

### Key Advantages

- Quiet, ultra-high performance
- DiscWizard™ software makes installation a snap
- Built-in self-monitoring technology helps ensure maximum reliability

### Best-Fit Applications

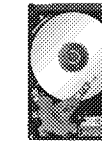
- Gaming PCs
- Workstations
- High-end PCs
- Desktop RAID
- Mainstream/office PCs



CAPACITY¹	KIT NUMBER²	RPM	INTERFACE	OS
2TB	ST320005N4A1AS-RK	7200	SATA 3Gb/s	PC, Mac
2TB	ST320005N4A1AS-RK	5900	SATA 3Gb/s	PC, Mac
1.5TB	ST315005N4A1AS-RK	5900	SATA 3Gb/s	PC, Mac
1TB	ST310005N1A1AS-RK	7200	SATA 3Gb/s	PC, Mac
500GB	ST3500641AS-RK	7200	SATA 3Gb/s	PC, Mac
PACKAGE DIMENSIONS	7.38-in L x 5.88-in W x 2.88-in D (187mm x 149mm x 73mm)			



## Product Comparison



	MOMENTUS® 2.5-INCH INTERNAL KIT	MOMENTUS XT	MOMENTUS	MOMENTUS THIN
<b>Application</b>	Mainstream and Performance	Extreme Performance	Mainstream	Slim Computing
<b>Description</b>	A complete upgrade kit to transform your system to high performance or just add capacity	Solid state hybrid drives deliver SSD-like performance without sacrificing capacity	The best combination of capacity, mobility and durability in a laptop hard drive	The world's thinnest 2.5-inch drive for slim laptops and netbooks
<b>Form Factor</b>	2.5 inch	2.5 inch	2.5 inch	7mm, 2.5-inch
<b>Performance</b>	5400 RPM to 7200 RPM	7200 RPM	5400 RPM to 7200 RPM	5400 RPM
<b>Reliability (AFR)</b>	0.40% to 0.50%	0.50%	0.40% to 0.50%	0.40%
<b>Max. Ext. Transfer Rate</b>	300MB/s	300MB/s	300MB/s	300MB/s
<b>Capacity<sup>1</sup></b>	250GB to 500GB	250GB to 500GB	160GB to 750GB	160GB and 250GB
<b>Interface</b>	SATA 3Gb/s	SATA 3Gb/s	SATA 3Gb/s	SATA 3Gb/s
<b>Cache</b>	8MB to 16MB	32MB	8MB to 16MB	8MB
<b>Power (Idle)</b>		0.8W	0.7W to 1.0W	0.7W to 0.8W

## Feature Comparison



Product	Mainstream and Performance	Extreme Performance	Mainstream		Slim Computing
	Momentus 2.5-Inch Internal Kit	Momentus XT	Momentus	Momentus FDE	Momentus Thin
<b>SATA Interface</b>	X	X	X	X	X
<b>Lowest Acoustics</b>			X	X	X
<b>Lowest Power</b>			X	X	X
<b>Self-Encrypting Drive</b>				X	
<b>Drop Sensor Options</b>			X	X	
<b>Solid State Hybrid</b>		X			
<b>Compatible with Windows 7<sup>2</sup></b>	X		Momentus 7200.4 Momentus 5400.5	X	X

## LAPTOP STORAGE

Seagate laptop drives address every mobile market need, delivering superior performance, reliability and value. Drives utilizing Seagate Secure<sup>®</sup> technology provide a robust platform for developing and deploying stronger security solutions.

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 7, visit: <http://www.seagate.com/windows/compatibility/windows-7/en-us/Search.aspx?type=Hardware&se=seagate>



# Momentus® XT

featuring Adaptive Memory™

The Seagate Momentus XT solid-state hybrid drive enables laptop PC users to enjoy solid state performance without sacrificing capacity.

### Key Advantages

- Adaptive Memory™ technology customizes performance by aligning to user needs for improved system response.
- 80 percent faster performance than traditional drives
- Low heat and vibration
- OS- and application-independent—designed for any SATA standard laptop PC
- Seagate 5-Year Limited Warranty

### Best-Fit Applications

- High-end laptops and workstations
- High-performance gamer laptops
- Fast external enclosures: USB 3.0, eSATA
- Small form factor PCs



CAPACITY	2400 RPM MODEL	INTERFACE	CACHE
500GB	ST95005620AS	SATA 3Gb/s	32MB
320GB	ST93205620AS	SATA 3Gb/s	32MB
250GB	ST92505610AS	SATA 3Gb/s	32MB

# Momentus®

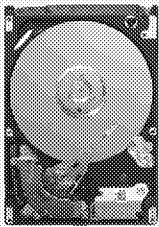
The Seagate Momentus drive offers the world's most feature-rich 2.5-inch family of storage for laptops and external enclosures.

### Key Advantages

- Innovative options and features—the power to transform from ordinary to extraordinary
- 7200 RPM delivers a constant high-performance boost.
- 5400 RPM enables affordable, low-power and high-capacity drives for external enclosures.
- G-Force Protection™ technology can help keep your data recoverable after a fall, even if your laptop doesn't survive.
- Seagate SmartAlign™ technology provides a transition to 4K sectors without the need for software utilities.

### Best-Fit Applications

- Mainstream and high-performance laptops
- External storage solutions, boxes
- Industrial applications requiring a small form factor



CAPACITY	2400 RPM MODEL	INTERFACE	CACHE
750GB	ST9750420AS <sup>1</sup>	SATA 3Gb/s	16MB
500GB	ST9500420AS	SATA 3Gb/s	16MB
500GB	ST9500420ASG <sup>2</sup>	SATA 3Gb/s	16MB
320GB	ST9320423AS	SATA 3Gb/s	16MB
250GB	ST9250410AS	SATA 3Gb/s	16MB
250GB	ST9250410ASG <sup>2</sup>	SATA 3Gb/s	16MB
160GB	ST9160412AS	SATA 3Gb/s	16MB
CAPACITY	5400 RPM MODEL	INTERFACE	CACHE
640GB	ST9640320AS	SATA 3Gb/s	8MB
500GB	ST9500325AS	SATA 3Gb/s	8MB
500GB	ST9500325ASG <sup>2</sup>	SATA 3Gb/s	8MB
320GB	ST9320325AS	SATA 3Gb/s	8MB
250GB	ST9250315AS	SATA 3Gb/s	8MB
160GB	ST9160314AS	SATA 3Gb/s	8MB

# Momentus® FDE

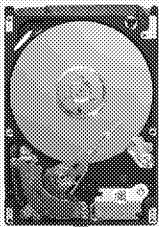
The Seagate Momentus FDE drive delivers built-in, government-grade data encryption storage for high-performance personal or business laptops.

### Key Advantages

- Self-Encrypting Drives mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drives with FIPS 140-2 certification<sup>4</sup> are government-approved for the U.S. and Canadian governments.
- Easy to implement—encryption is always on
- Hardware encryption—no impact on system performance
- Works with multiple security software applications

### Best-Fit Applications

- Corporate laptops with confidential information
- Field sales/support laptops with customer data
- Personal laptops with sensitive information
- Industrial applications such as ATMs and POS

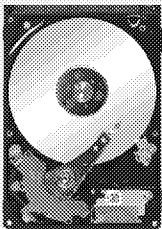


CAPACITY	2400 RPM MODEL	INTERFACE	CACHE
500GB	ST9500421AS	SATA 3Gb/s	16MB
500GB	ST9500422AS <sup>1</sup>	SATA 3Gb/s	16MB
250GB	ST9250411AS	SATA 3Gb/s	16MB
250GB	ST9250412AS <sup>1</sup>	SATA 3Gb/s	16MB
CAPACITY	5400 RPM MODEL	INTERFACE	CACHE
500GB	ST9500327AS	SATA 3Gb/s	8MB
250GB	ST9250317AS	SATA 3Gb/s	8MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Drive with G-Force Protection™ feature  
<sup>3</sup> Drive with SmartAlign™ technology  
<sup>4</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/ST/ommp/documents/140-1/1401vend.htm>.

# Momentum® Thin

The 7mm, 2.5-inch drive enables slim computing for all types of mobile computing, from laptops to netbooks to smaller desktop PCs.



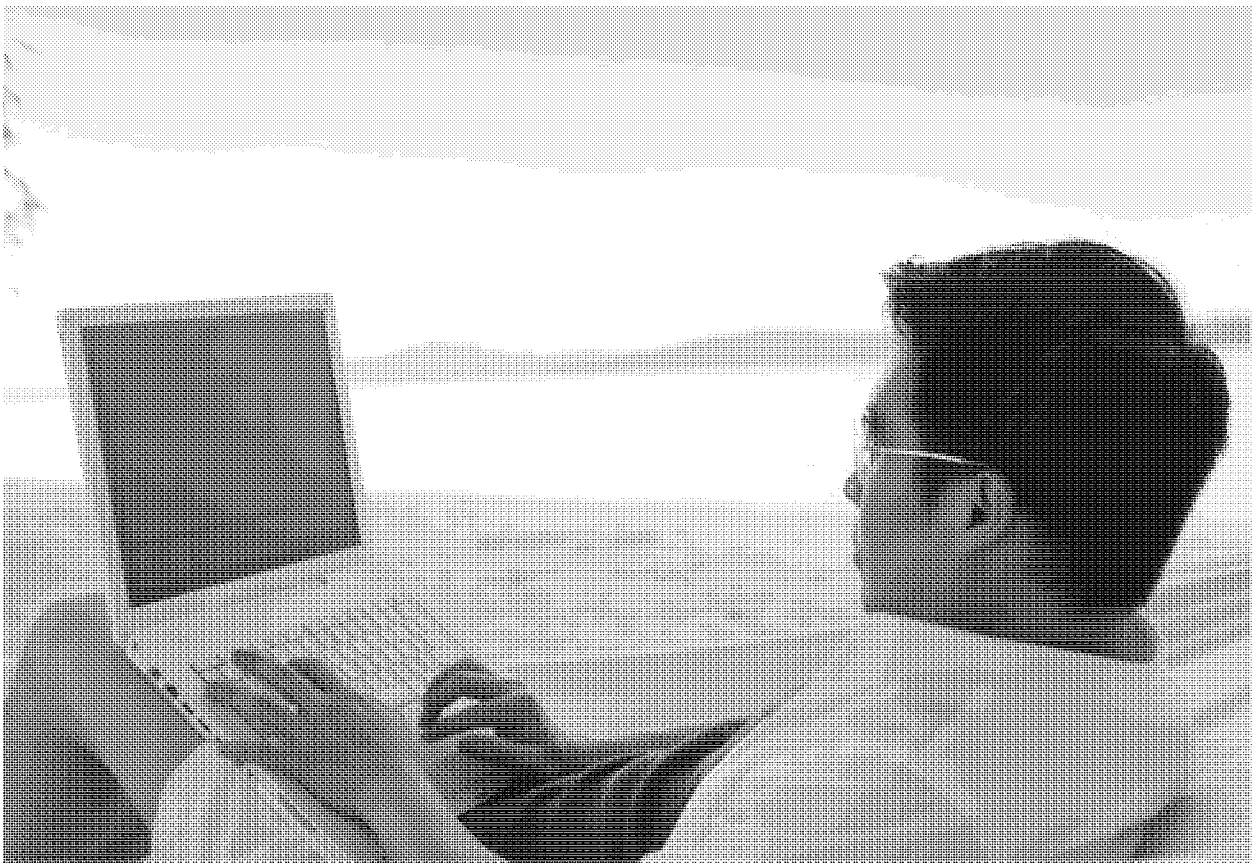
### Key Advantages

- Enables slim solutions for all segments of notebook computing
- Allows OEMs in the entry-level laptop space to differentiate with sleeker designs
- Brings fully functional, high-value storage to high-end netbooks

### Best-Fit Applications

- Thin entry-level laptop PCs
- Thin high-end netbooks
- Thin ultraportables
- Slim CE devices

CAPACITY	MODEL	INTERFACE	THIN
250GB	ST92503010AS	SATA 3Gb/s	8MB
160GB	ST91603010AS	SATA 3Gb/s	8MB



# Momentum® 2.5-Inch Internal

Seagate 2.5-inch internal drives deliver vast amounts of storage for adding capacity or upgrading drives in laptop computers.



### Key Advantages

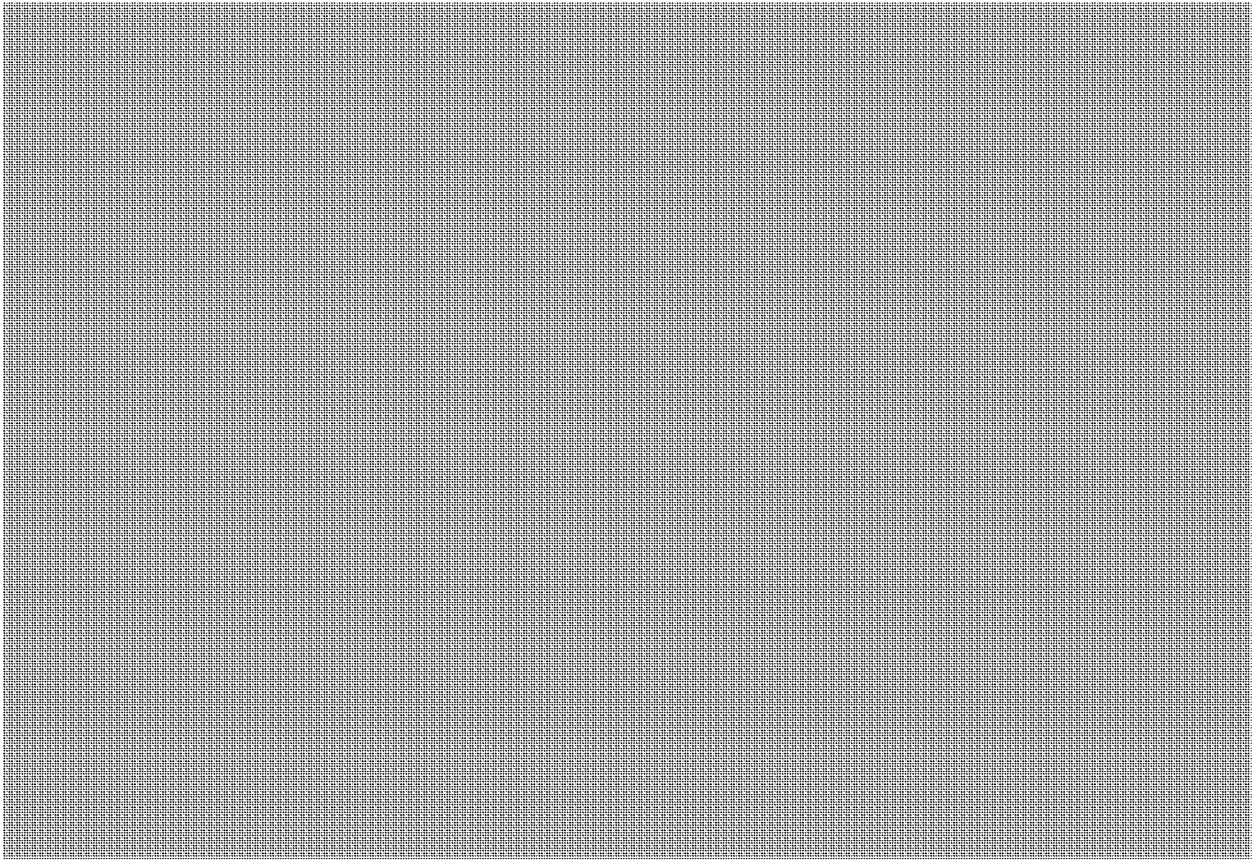
- Built for mobility
- Preserves battery life
- Large data cache
- Outstanding performance
- Momentum XT solid state hybrid model offers SSD-like performance with the capacity of a hard drive.

### Best-Fit Applications

- Replacement laptop drives
- Laptop storage upgrades
- High-end laptops and workstations

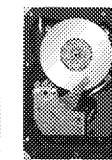
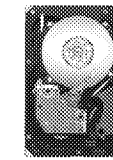
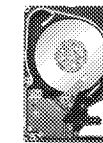
CAPACITY	MODEL NUMBER	RPM	INTERFACE	OS
840GB	ST908403N1A1AS-RK	5400	SATA 3Gb/s	PC, Mac
500GB	ST905003N1A1AS-RK	5400	SATA 3Gb/s	PC, Mac
320GB	ST903203N3A1AS-RK	7200	SATA 3Gb/s	PC, Mac
320GB	ST903203N1A2AS-RK	5400	SATA 3Gb/s	PC, Mac
250GB	ST90250N1A1AS-RK	5400	SATA 3Gb/s	PC, Mac
PKG DIMS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)			

Momentum XT Model				
500GB	SAN500100-RK	7200	SATA 3Gb/s	PC, Mac NEW
PKG DIMS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)			





## Product Comparison

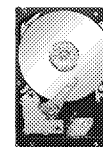
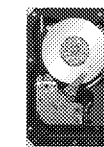
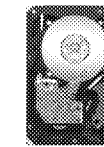
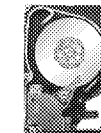


	SAVVIO®	CHEETAH®	CONSTELLATION®
<b>Application</b>	SFF Performance and Mainstream	LFF Performance and Mainstream	High Capacity and Low Power
<b>Description</b>	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 2.5-inch form factor	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 3.5-inch form factor	High-capacity, lowest-power, reliable 7200-RPM enterprise hard drive in both 2.5- and 3.5-inch form factors
<b>Form Factor</b>	2.5-inch	3.5-inch	2.5-inch and 3.5-inch
<b>Performance</b>	15K RPM and 10K RPM	15K RPM and 10K RPM	7200 RPM
<b>Reliability (AFR)</b>	0.55% and 0.44%	0.55%	0.73%
<b>Capacity¹</b>	73GB to 600GB	300GB to 600GB	160GB to 2TB
<b>Power (Idle)</b>	3.7W to 4.6W	5.6W to 11.68W	2.3W to 8.0W
<b>Interface</b>	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, SATA 3Gb/s
<b>Workload (Power-On Hours)</b>	8760 or 24×7	8760 or 24×7	8760 or 24×7
<b>Limited Warranty</b>	5 years	5 years	5 years

# ENTERPRISE STORAGE

Whether you have a small or medium business or run a large data center, Seagate offers superior 3.5-inch and 2.5-inch enterprise drives that are perfect for a wide range of server, storage, backup and archive applications.

## Feature Comparison



	2.5-Inch Mission Critical		3.5-Inch Mission Critical		2.5-Inch Nearline	3.5-Inch Nearline
<b>Product</b>	Savvio 15K	Savvio 10K	Cheetah 15K	Cheetah NS	Constellation	Constellation ES
<b>Best-in-Class Performance</b>	X		X		X	X
<b>Capacity Leadership</b>		X	X	X		X
<b>Vibration Tolerance for Multi-Drive Stabilization</b>	X	X	X	X	X	X
<b>6Gb/s SAS Interface</b>	X	X	X	X	X	X
<b>4Gb/s FC Interface</b>		X	X	X		
<b>3Gb/s SATA Interface</b>					X	X
<b>Best-in-Class Power Usage</b>		X		X	X	X
<b>PowerChoice™ Optimized Idle Power Settings</b>		X			X	X
<b>Self-Encrypting Drive (SED)²</b>	X	X	X		X	X
<b>FIPS 140-2 SED³</b>	X	X	X		X	X

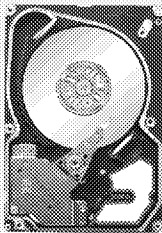
1 One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

2 Self-Encrypting Drive models require TCG-compliant host or controller support.

3 See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cmvp/documents/140-1/1401vend.htm>.

Savvio® 15K

The 2.5-inch Seagate Savvio 15K hard drive provides the world's highest performance and reliability while delivering ultra-low power consumption.



Key Advantages

- 115 percent improvement in system-level performance over 3.5-inch drives
- PowerTrim™ technology reduces power 70 percent over comparable 3.5-inch 15K drives.
- Smaller form factor reduces system cooling costs.
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

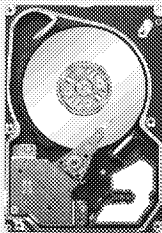
Best-Fit Applications

- High-performance enterprise servers and storage arrays
- Transaction-intensive database applications
- Blade, rack and tower servers
- Security compliance-driven IT organizations

CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE	
146GB	ST9146852SS	6Gb/s SAS	16MB	
146GB	ST9146752SS <sup>2</sup>	6Gb/s SAS	16MB	
146GB	ST9146652SS <sup>2,3</sup>	6Gb/s SAS	16MB	NEW
73GB	ST973452SS	6Gb/s SAS	16MB	
73GB	ST973352SS <sup>2</sup>	6Gb/s SAS	16MB	
73GB	ST973252SS <sup>2,3</sup>	6Gb/s SAS	16MB	NEW

Savvio® 10K

Seagate Savvio 10K drives are the highest capacity, most reliable 2.5-inch drives for the enterprise.



Key Advantages

- Highest-capacity enterprise SFF hard drive (up to 600GB)
- 20 percent higher reliability than any other drive
- PowerTrim™ and PowerChoice™ technologies reduce power consumption.
- First SFF 10K-RPM drive to support 4Gb/s FC
- Protection Information (PI) option detects corruption of data in flight between the host system and the drive<sup>4</sup>
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

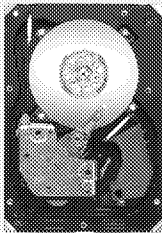
Best-Fit Applications

- Mainstream enterprise servers and storage arrays
- Power- or space-constrained data centers
- Security compliance-driven IT organizations

CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE	
600GB	ST9600204SS	6Gb/s SAS	16MB	
600GB	ST9600104SS <sup>2</sup>	6Gb/s SAS	16MB	
600GB	ST9600004SS <sup>2,3</sup>	6Gb/s SAS	16MB	NEW
600GB	ST9600204FC	4Gb/s FC	16MB	
450GB	ST9450404SS	6Gb/s SAS	16MB	
450GB	ST9450304SS <sup>2</sup>	6Gb/s SAS	16MB	
450GB	ST9450204SS <sup>2,3</sup>	6Gb/s SAS	16MB	NEW
450GB	ST9450404FC	4Gb/s FC	16MB	

Cheetah® 15K

The Seagate Cheetah 15K drive provides the highest capacity, performance and reliability in 3.5-inch mission-critical storage.



Key Advantages

- Third-generation perpendicular recording
- Sustained data rate of up to 204MB/s
- Industry's highest 3.5-inch drive reliability
- PowerTrim™ technology optimizes power consumption
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.
- Ultra320 SCSI interface models available

Best-Fit Applications

- Business and transaction processing
- Email and decision support
- Storage area networks (SAN)
- Network attached storage (NAS)
- Internet and e-commerce
- Security compliance-driven IT organizations

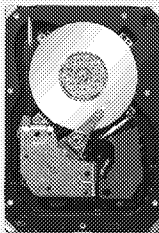
CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE	
600GB	ST3600057SS	6Gb/s SAS	16MB	
600GB	ST3600957SS <sup>2</sup>	6Gb/s SAS	16MB	
600GB	ST3600857SS <sup>2,3</sup>	6Gb/s SAS	16MB	NEW
600GB	ST3600057FC	4Gb/s FC	16MB	
600GB	ST3600957FC <sup>2</sup>	4Gb/s FC	16MB	
600GB	ST3600857FC <sup>2,3</sup>	4Gb/s FC	16MB	NEW
450GB	ST3450857SS	6Gb/s SAS	16MB	
450GB	ST3450757SS <sup>2</sup>	6Gb/s SAS	16MB	
450GB	ST3450657SS <sup>2,3</sup>	6Gb/s SAS	16MB	NEW
450GB	ST3450857FC	4Gb/s FC	16MB	
450GB	ST3450757FC <sup>2</sup>	4Gb/s FC	16MB	
450GB	ST3450657FC <sup>2,3</sup>	4Gb/s FC	16MB	NEW
300GB	ST3300857SS	6Gb/s SAS	16MB	
300GB	ST3300557SS <sup>2</sup>	6Gb/s SAS	16MB	
300GB	ST3300457SS <sup>2,3</sup>	6Gb/s SAS	16MB	NEW
300GB	ST3300857FC	4Gb/s FC	16MB	
300GB	ST3300557FC <sup>2</sup>	4Gb/s FC	16MB	
300GB	ST3300457FC <sup>2,3</sup>	4Gb/s FC	16MB	NEW

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models require FIPS-compliant host or controller support.  
<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://www.nist.gov/groups/ST/comm/documents/f140-1/f1401vend.htm>.  
<sup>4</sup> Protection Information (PI) feature requires PI-compliant host or controller support.



# Cheetah® NS

The Seagate Cheetah NS drive delivers the lowest-power, highest-reliability combination for 3.5-inch Tier 1 solutions.



### Key Advantages

- Highest-capacity Tier 1 drive (600GB)
- Highest LFF reliability rating in the industry, with a 0.55% annualized failure rate (AFR)
- Seagate PowerTrim technology dynamically reduces power usage.

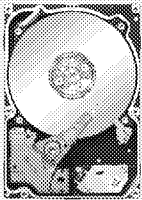
### Best-Fit Applications

- Mainstream enterprise applications
- Business and transaction processing
- Storage area networks (SAN)
- Networked attached storage (NAS)

CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
600GB	ST3600002SS	6Gb/s SAS	16MB
600GB	ST3600002FC	4Gb/s FC	16MB
450GB	ST3450802SS	6Gb/s SAS	16MB
450GB	ST3450802FC	4Gb/s FC	16MB
300GB	ST3300602FC	4Gb/s FC	16MB

# Constellation®

Seagate Constellation 2.5-inch hard drives offer power savings, high capacity and performance, reliability and optional security for high-density enterprise applications.



### Key Advantages

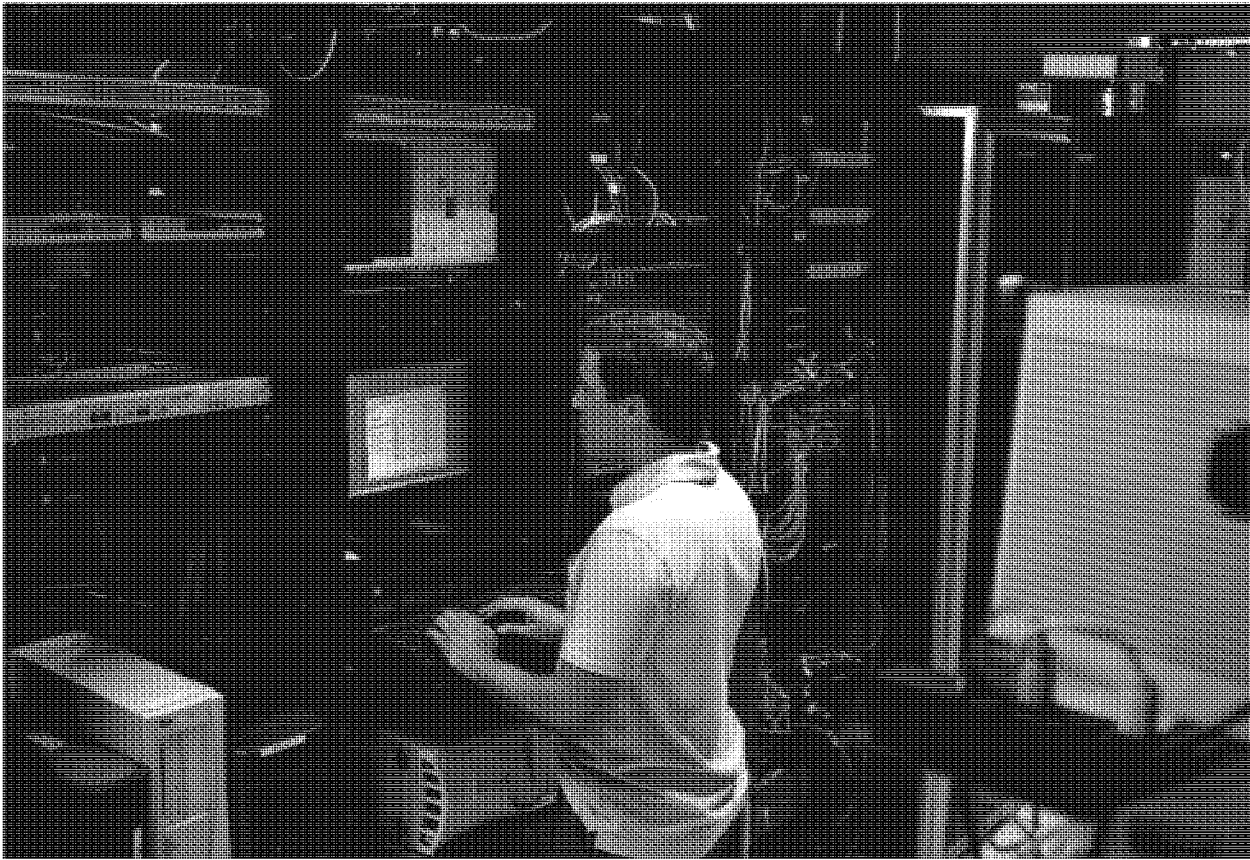
- 15mm enterprise-class nearline drive
- Industry's highest-reliability 7200-RPM drive
- Optimal power savings with PowerChoice™ technology
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- External storage arrays (SAN, DAS, NAS)
- Maximum-capacity servers and blade servers
- Rich media content storage—audio, video, image
- Reference and compliance data storage
- Security compliance-driven IT organizations

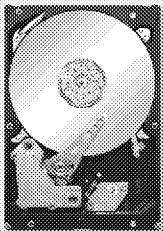
CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
500GB	ST9500430SS	6Gb/s SAS, 3Gb/s SAS	16MB
500GB	ST9500431SS <sup>2</sup>	6Gb/s SAS, 3Gb/s SAS	16MB
500GB	ST9500432SS <sup>2,3</sup>	6Gb/s SAS, 3Gb/s SAS	16MB
500GB	ST9500530NS	SATA 3Gb/s or 1.5Gb/s	32MB
160GB	ST9160511NS	SATA 3Gb/s or 1.5Gb/s	32MB

NEW



# Constellation® ES

Seagate Constellation ES 3.5-inch hard drives offer the highest capacity at 2TB while providing enterprise robustness for seamless enterprise integration.



### Key Advantages

- The industry's highest 7200-RPM reliability
- Best-in-class rotational vibration tolerance
- Multi-drive firmware maximizes system availability.
- Optimal power savings with PowerChoice™ technology
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Maximum-capacity servers and storage arrays
- Rich media content storage—audio, video, image
- Reference and compliance data storage
- Video surveillance and internet data centers
- Security compliance-driven IT organizations

CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
2TB	ST32000644NS	SATA 3Gb/s	64MB
2TB	ST32000444SS	6Gb/s SAS	16MB
2TB	ST32000445SS <sup>2</sup>	6Gb/s SAS	16MB
2TB	ST32000446SS <sup>2,3</sup>	6Gb/s SAS	16MB
1TB	ST31000524NS	SATA 3Gb/s	32MB
1TB	ST31000424SS	6Gb/s SAS	16MB
1TB	ST31000425SS <sup>2</sup>	6Gb/s SAS	16MB
1TB	ST31000426SS <sup>2,3</sup>	6Gb/s SAS	16MB
500GB	ST3500514NS	SATA 3Gb/s	32MB
500GB	ST3500414SS	6Gb/s SAS	16MB
500GB	ST3500415SS <sup>2</sup>	6Gb/s SAS	16MB
500GB	ST3500416SS <sup>2,3</sup>	6Gb/s SAS	16MB

NEW

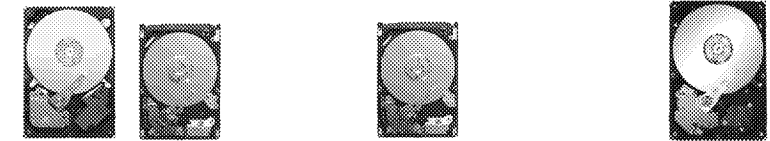
NEW

NEW

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models require TCG-compliant host or controller support.  
<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cmvr/documents/140-1/1401vend.htm>.



## Product Comparison



	PIPELINE®	EE25 SERIES™	SV35 SERIES™
<b>Application</b>	Mainstream CE-DVR	Rugged and Extreme	Surveillance
<b>Description</b>	Unprecedented levels of acoustic, power and vibration performance with room for hundreds of movies	Rugged drives designed for reliable performance in extreme environmental applications	Optimized performance, power savings and improved reliability for video surveillance applications
<b>Form Factor</b>	3.5 inch and 2.5 inch	2.5 inch	3.5 inch
<b>Performance</b>	Able to stream at least 12 simultaneous, 20Mb/s, high-definition video streams	5400 RPM	5900 RPM to 7200 RPM
<b>Reliability (AFR)</b>	0.55%	<1%	<1%
<b>Max. Ext. Transfer Rate</b>	300MB/s	100 MB/s to 300MB/s	300MB/s
<b>Capacity</b>	160GB to 1TB	40GB to 80GB	500GB to 1TB
<b>Interface</b>	SATA 3Gb/s	SATA 3Gb/s, ATA	SATA 3Gb/s
<b>Cache</b>	8MB	8MB	32MB
<b>Power (Idle)</b>	0.8W to 4.3W	1.7W to 2.4W	5.0W to 7.0W

## Feature Comparison



	3.5-Inch CE-DVR	2.5-Inch CE-DVR	Rugged	Surveillance
<b>Product</b>	Pipeline HD	Pipeline HD Mini	EE25 Series	SV35 Series
<b>SATA Interface</b>	X	X	X	X
<b>ATA Interface</b>			X	
<b>Low Power</b>	X	X		
<b>Quiet Acoustics</b>	X	X		
<b>Cool Operation</b>	X	X		X
<b>Small Form Factor Applications</b>		X		
<b>Sustainable Technology</b>	X	X		
<b>Best-in-Class Performance</b>	X	X	X	X
<b>Capacity Leadership</b>	X			
<b>Extreme Environments</b>			X	
<b>24x7 Operation Capable</b>	X	X	X	X
<b>Extremely Low Vibration</b>	X	X	X	

# CONSUMER ELECTRONICS

**Storage solutions for DVRs, media centers, surveillance systems and extreme environments**

Seagate provides global scale, supply and support for CE integrators and a complete business and technology partnership for the entertainment market.

# Pipeline HD® Mini

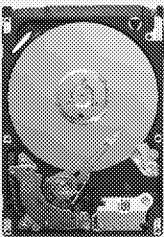
Seagate Pipeline HD Mini, the world's first purpose-built 2.5-inch DVR drive tuned for video streaming and low power consumption

### Key Advantages

- Built for small form factor (SFF) focused designs
- Cool and quiet video streaming performance
- Operational power consumption as low as 1.54W
- 75°C, 24-hour operation capable
- 1.0A spin-up current limited

### Best-Fit Applications

- SFF DVR/PVR-enabled set-top boxes
- SFF Home media/theater PCs and servers
- SFF Karaoke and audio jukeboxes
- SFF AV-oriented external storage



CAPACITY	MODEL	INTERFACE	CACHE
250GB	ST9250311CS	SATA 3Gb/s NCQ	8MB
160GB	ST91603110CS	SATA 3Gb/s NCQ	8MB

# EE25 Series™

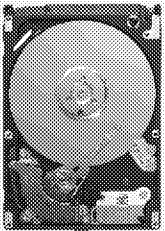
Rugged Seagate EE25 Series drives are designed for reliable performance in extreme environmental applications.

### Key Advantages

- Ability to operate at extreme altitude
- Extends operating temperatures from -30°C to +85°C
- Delivers maximum reliability in adverse conditions
- Built for reliable 24x7 operation
- Industry best-in-class 1-million-hour MTBF

### Best-Fit Applications

- Automotive, marine and similar mobile storage applications
- Ruggedized laptop computers
- Commercial/industrial control systems
- Military, medical, surveillance, digital signage and other rugged applications



CAPACITY	MODEL	INTERFACE	CACHE
80GB	ST980817AM <sup>1</sup>	ATA	8MB
80GB	ST980817SM <sup>1</sup>	SATA	8MB
80GB	ST980818AM <sup>1</sup>	ATA	8MB
80GB	ST980818SM <sup>1</sup>	SATA	8MB
40GB	ST940817AM <sup>1</sup>	ATA	8MB
40GB	ST940817SM <sup>1</sup>	SATA	8MB
40GB	ST940818AM <sup>1</sup>	ATA	8MB
40GB	ST940818SM <sup>1</sup>	SATA	8MB

# Pipeline HD®

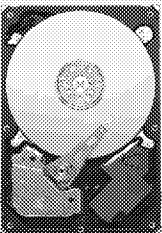
Seagate Pipeline HD drives deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

### Key Advantages

- Virtually silent streaming performance as low as 19dB
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

### Best-Fit Applications

- DVR/PVR-enabled set-top boxes
- Home media/theater PCs and servers
- Karaoke and audio jukeboxes
- AV-oriented external storage



CAPACITY	MODEL	INTERFACE	CACHE
1TB	ST31000322CS	SATA 3Gb/s NCQ	8MB
500GB	ST3500312CS	SATA 3Gb/s NCQ	8MB
320GB	ST3320311CS	SATA 3Gb/s NCQ	8MB
250GB	ST3250312CS	SATA 3Gb/s NCQ	8MB
160GB	ST3160316CS	SATA 3Gb/s NCQ	8MB

# SV35 Series™

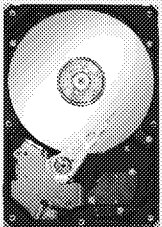
The Seagate SV35 Series optimize performance, save power and improve reliability for video surveillance applications.

### Key Advantages

- Higher areal density for cost-effective DVR applications
- Performance-tuned for seamless video applications
- Enterprise-class reliability for 24x7 video surveillance applications
- Built-in error recovery for non-stop streaming

### Best-Fit Applications

- Video surveillance digital video recorder
- Video surveillance network digital video recorder
- Direct-attached JBOD video surveillance storage
- Network-attached JBOD video storage



CAPACITY	MODEL	INTERFACE	CACHE
1TB	ST31000525SV	SATA 3Gb/s NCQ	32MB
500GB	ST3500410SV	SATA 3Gb/s NCQ	16MB



## PARTNER RESOURCES AND BENEFITS

The Seagate Partner Program (SPP) provides access to unique resources and benefits to help channel partners secure new opportunities and grow revenue and profitability.

Enhanced benefits for channel partners include:

- Educational product and marketing seminars
- Dedicated pre/post sales support
- Discounted evaluation units
- Free online product training
- Access to a merchandise mart

**Start reaping the rewards of SPP membership—register today at [seagate.com/partners](http://seagate.com/partners).**

- Complete the online form.
- Click through and accept our standard agreement.



## SERVICE AND SUPPORT

For information regarding products and services, visit

[http://www.seagate.com/www/en-us/about/contact\\_us/](http://www.seagate.com/www/en-us/about/contact_us/)

Available services include:

- Presales and Technical Support
- Global Support Services telephone numbers and business hours
- Authorized Seagate Service Centers

For information regarding Warranty Support, visit

[http://www.seagate.com/www/en-us/support/warranty/\\_&\\_returns\\_assistance](http://www.seagate.com/www/en-us/support/warranty/_&_returns_assistance)

For information regarding Data Recovery Services, visit

<http://www.i365.com>

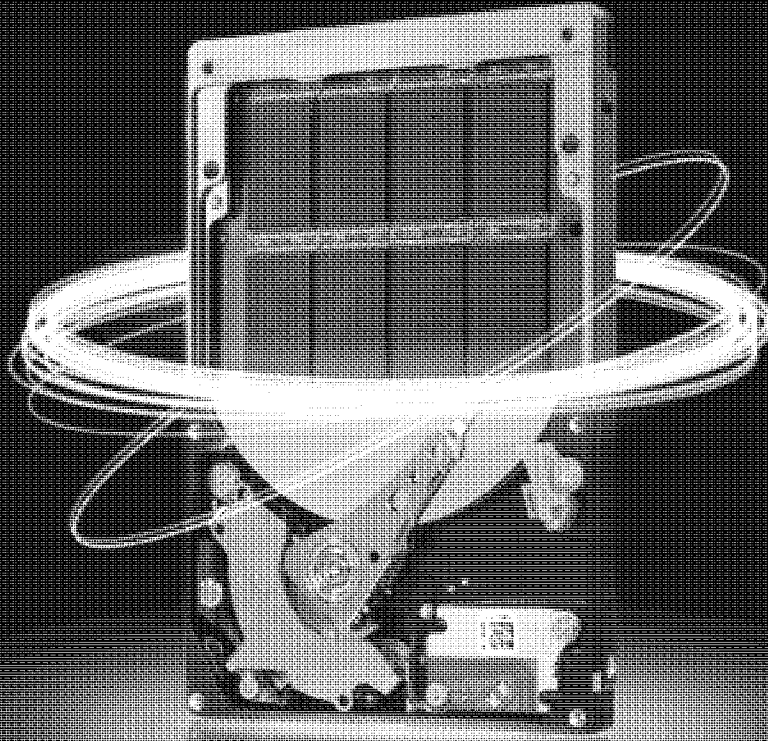
For Seagate OEM and Distribution partner portal, visit

<https://direct.seagate.com/portal/system>

For Seagate reseller portal, visit

<http://spp.seagate.com>





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of both SSD and HDD

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featuring Adaptive Memory™ technology  
for blazing laptop performance

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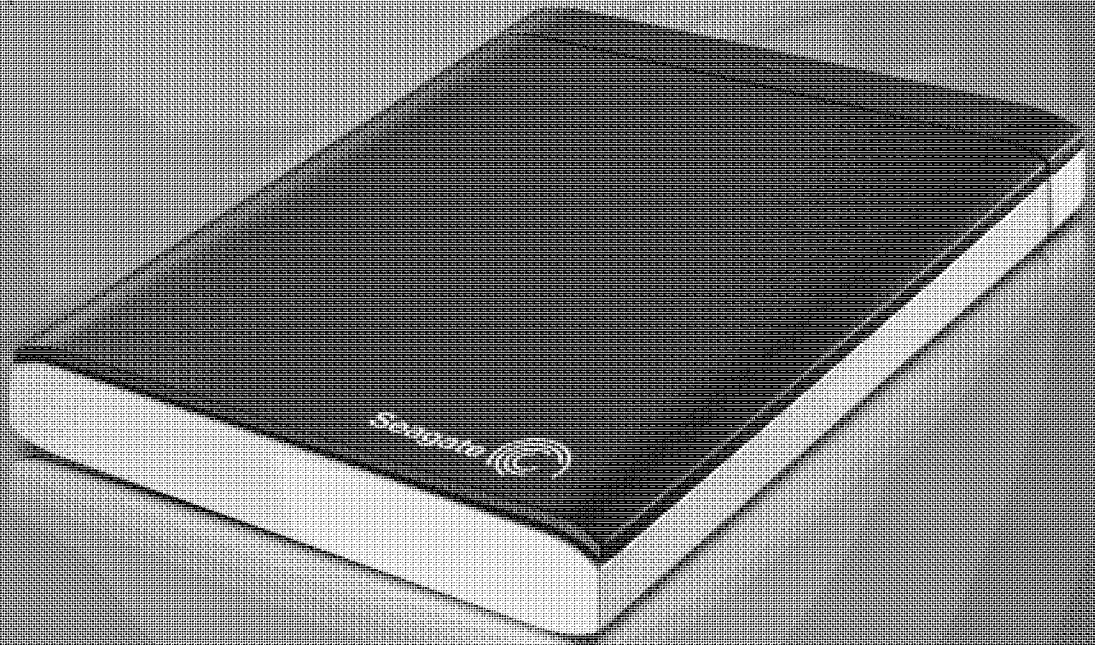
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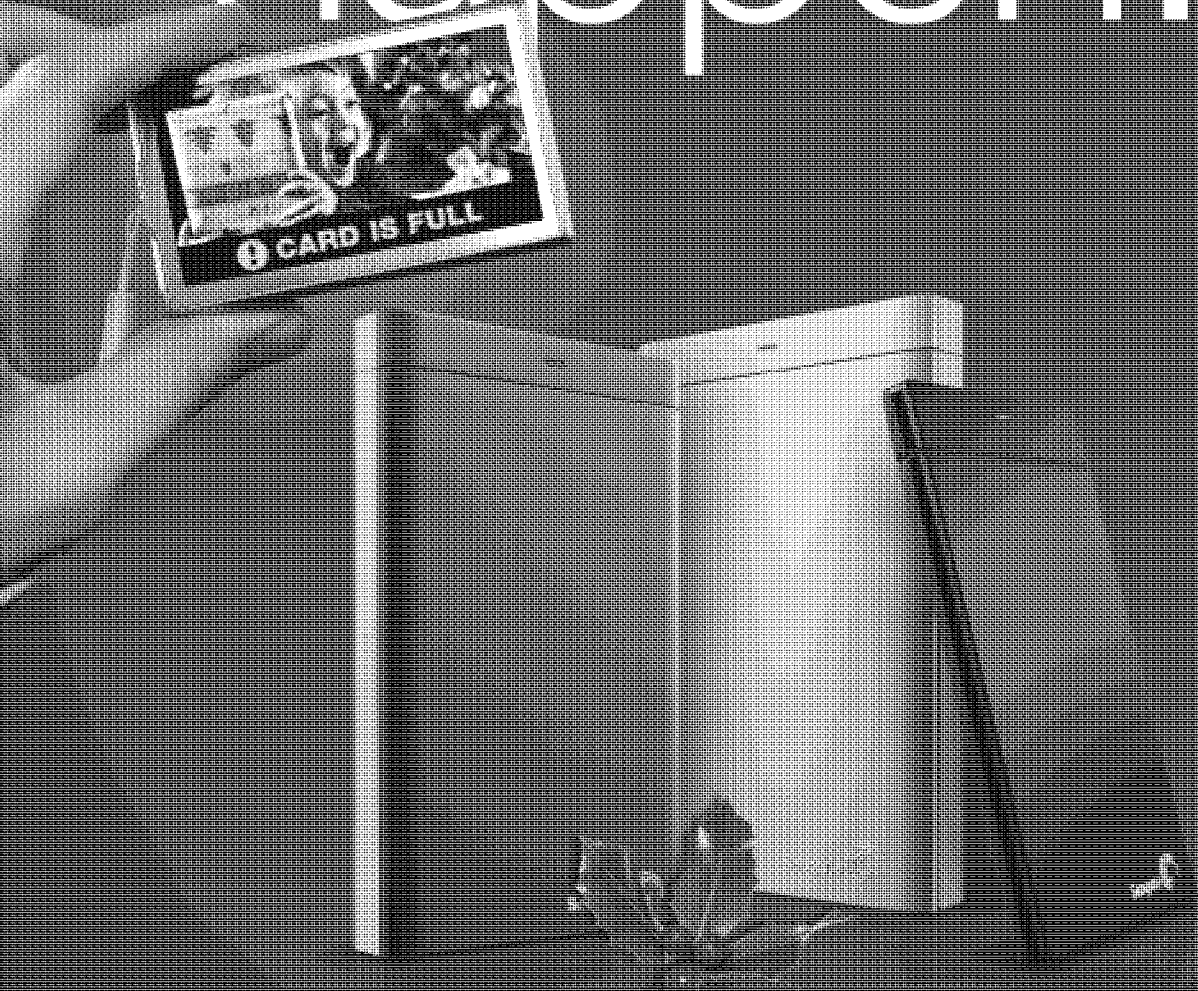


# Storage Solutions Guide

OCT 2012 | AMER



# Holidays happen.



## Back them up.

With a Backup Plus drive, they'll never miss the moment.



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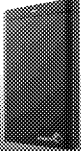


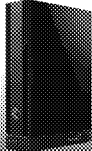
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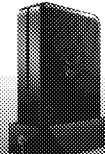
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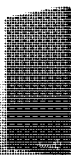

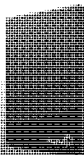
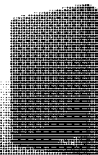
# External Storage

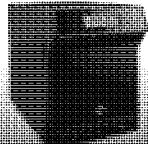
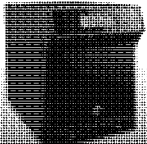

## At-a-Glance Product Comparison

BACKUP PLUS				
Direct Attached/ Portable				
	Backup Plus Portable	Backup Plus Portable for Mac	Thunderbolt™ Backup Plus for Mac Portable	Backup Plus Desktop for Mac
PERFECT FOR	Protecting and sharing digital memories			Keeping your digital life safe and sound
DESCRIPTION	Store and back up the content on your social networks with these flexible, portable drives. PC or Mac.			These desktop drives provide the simple, one-click way to protect and share files. PC or Mac.
LEARN MORE	Page 5	Page 6	Page 6	Page 7

GOFLEX	
Wireless Mobile	
	GoFlex Satellite™
PERFECT FOR	Wireless storage for your tablet
DESCRIPTION	Take your media library on the go and stream it wirelessly to your iPad, Android tablet and smartphone. PC or Mac.
LEARN MORE	Page 10

GOFLEX	
Network Attached	
	GoFlex Home
PERFECT FOR	Wireless centralized home storage
DESCRIPTION	This network storage system supports the external storage needs of every computer in your home. PC or Mac.
LEARN MORE	Page 11

	SLIM		EXPANSION™	
				
<b>Thunderbolt™ Backup Plus for Mac Desktop</b>	<b>Slim Portable</b>	<b>Slim Portable for Mac</b>	<b>Expansion Portable</b>	<b>Expansion Desktop</b>
Keeping your digital life safe and sound	Thin storage that fits—and goes—anywhere		Protecting and sharing your digital life	
These desktop drives provide the simple, one-click way to protect and share files. PC or Mac.	This ultra-thin metal design is the world's sleekest portable external hard drive. PC or Mac.		Expansion drives allow you to instantly add more storage space to your computer and take large files with you.	
Page 7	Page 9	Page 8	Page 10	Page 9

BLACKARMOR®		
		
<b>BlackArmor NAS 440</b>	<b>BlackArmor NAS 400</b>	<b>BlackArmor NAS 220</b>
Full-system backup, RAID 0, 1, 5, 10 or JBOD		Full-system backup, RAID 0 or 1
A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations.		A network attached storage solution designed to provide centralized storage and data backup.
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# External Storage Solutions

Seagate external storage solutions are sleek, dependable and ultra-portable products that let your customers automatically and continuously store digital family photos, protect critical business data, back up multiple computers on a small network, or share and store videos and music.



# Backup Plus

The Backup Plus portable drive is the simple way to protect and share your entire digital life.

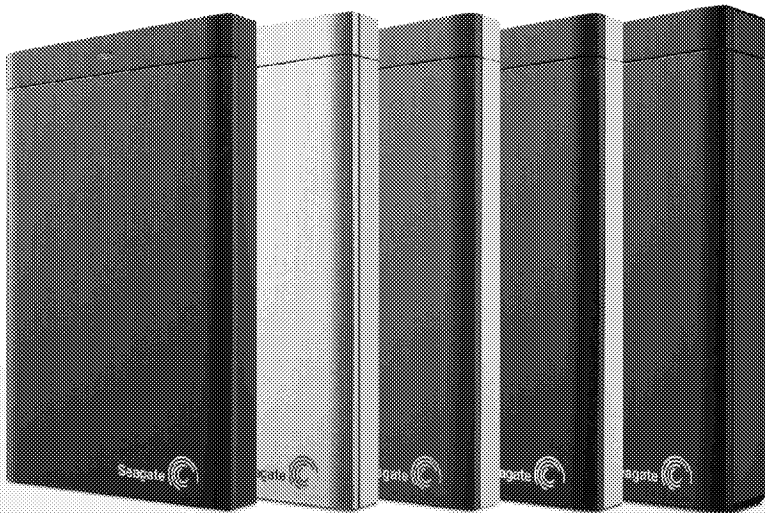
## Key Advantages

- Easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Thunderbolt technology or FireWire 800 upgrade allows higher transfer speeds

## Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.

CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBU1000100	USB 3.0	● Black	PC, Mac
1TB	STBU1000101	USB 3.0	● Silver	PC, Mac
1TB	STBU1000102	USB 3.0	● Blue	PC, Mac
1TB	STBU1000103	USB 3.0	● Red	PC, Mac
750GB	STBU750100	USB 3.0	● Black	PC, Mac
500GB	STBU500100	USB 3.0	● Black	PC, Mac
500GB	STBU500101	USB 3.0	● Silver	PC, Mac
500GB	STBU500102	USB 3.0	● Blue	PC, Mac
500GB	STBU500103	USB 3.0	● Red	PC, Mac
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.54-in D (132mm x 46mm x 166mm)			



<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.

# Backup Plus for Mac

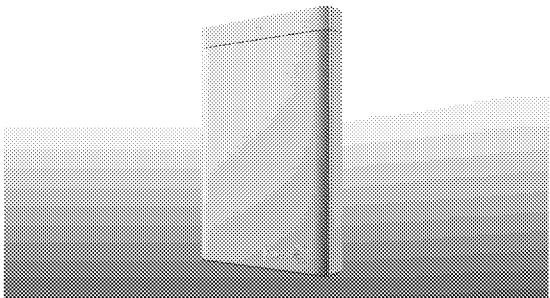
The Backup Plus portable drive for Mac is the simple way to protect and share your entire digital life.

### Key Advantages

- Mac OS and Time-Machine ready out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click.
- Easily increase transfer speeds by upgrading to Thunderbolt technology.

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY¹	KIT NUMBER²	INTERFACE	COLOR	OS
1TB	STBW1000301	USB 3.0	⊗ Silver/ ○ White	Mac, PC
500GB	STBW500301	USB 3.0	⊗ Silver/ ○ White	Mac, PC
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.54-in D (132mm x 46mm x 166mm)			

# Thunderbolt™ Backup Plus for Mac Portable

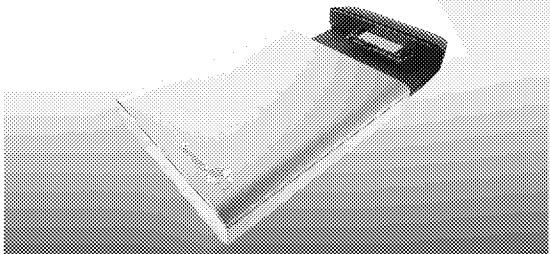
The Thunderbolt Backup Plus for Mac portable drive is everything you need to transfer, store and back up files using Thunderbolt technology.

### Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Compatible with Time Machine software
- Compatible with Thunderbolt devices
- No external power supply required

### Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gps



CAPACITY¹	KIT NUMBER²	INTERFACE	COLOR	OS
1TB	STBW1000401	Thunderbolt	● Black	Mac, PC
PRODUCT DIMENSIONS	5.12-in L x 3.19-in W x 1.09-in D (130mm x 81mm x 27.8mm)			
PACKAGE DIMENSIONS	6.69-in L x 5.24-in W x 1.81-in D (170mm x 133mm x 46mm)			

## Backup Plus Desktop for Mac

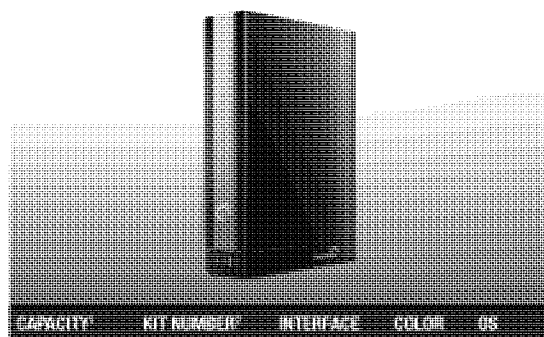
The Backup Plus desktop drive for Mac is the simple, one-click way to protect and share your entire digital life.

### Key Advantages

- Mac OS and Time Machine ready right out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click.
- Up to 3TB capacity for a lifetime of memories

### Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
3TB	STCB3000900	FireWire 800/ USB 3.0	● Black/ ● Silver	Mac, PC
2TB	STCB2000900	FireWire 800/ USB 3.0	● Black/ ● Silver	Mac, PC
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)		●	
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)		●	

## Thunderbolt Backup Plus for Mac Desktop

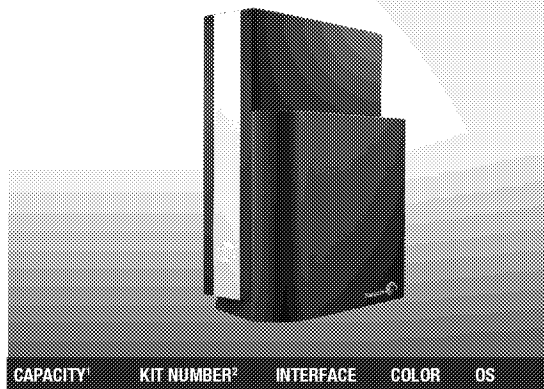
The Thunderbolt Backup Plus for Mac desktop drive is everything you need to transfer, store and back up files using Thunderbolt technology.

### Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Dual ports enable daisy-chaining up to six devices
- Compatible with Thunderbolt displays and other devices
- Compatible with Time Machine softwares

### Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gbps



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
3TB	STCB3000400	Thunderbolt	● Black	Mac, PC
PRODUCT DIMENSIONS	6.61-in L x 4.76-in W x 2.42-in D (168mm x 120.9mm x 61.4mm)			
PACKAGE DIMENSIONS	8.64-in L x 9.13-in W x 3.5-in D (219.5mm x 232mm x 89mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.



# Backup Plus Desktop

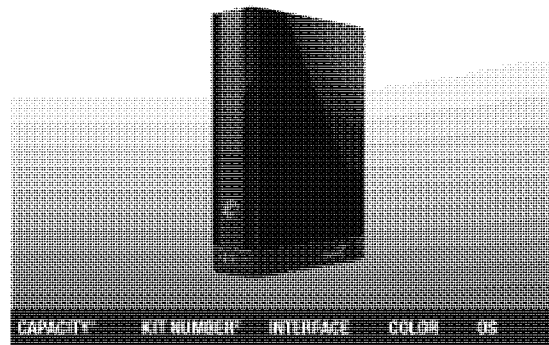
The Backup Plus desktop drive is the simple, one-click way to protect and share your entire digital life.

## Key Advantages

- Easy, flexible, built-in backup options
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Up to 4TB capacity for a lifetime of memories
- Increase transfer speeds by upgrading to Thunderbolt technology or FireWire 800.

## Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STCA4000100	USB 3.0	● Black	PC, Mac
3TB	STCA3000100	USB 3.0	● Black	PC, Mac
2TB	STCA2000100	USB 3.0	● Black	PC, Mac
1TB	STCA1000100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

# Slim Portable for Mac

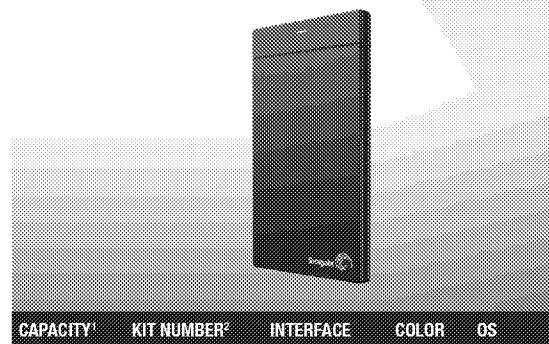
The Seagate Slim portable drive for Mac combines our thinnest, sleekest form factor in a Time Machine-ready drive.

## Key Advantages

- World's slimmest portable external hard drive
- Mac OS and Time Machine ready out of the box
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

## Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STCF500400	USB 3.0	● Black	Mac, PC
PRODUCT DIMENSIONS	4.91-in L x 3.07-in W x 0.35-in D (124.8mm x 78mm x 9mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.52-in D (132mm x 46mm x 165.5mm)			

## Slim Portable

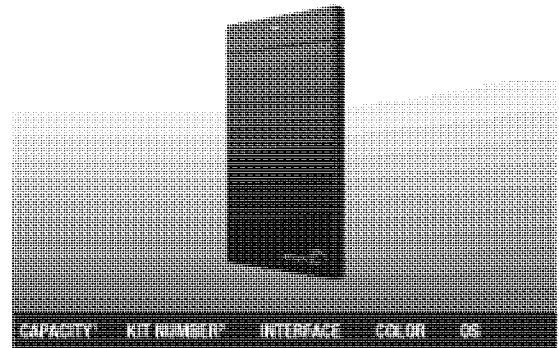
The Seagate Slim portable drive is our thinnest, sleekest way yet to back up the things that are important to you.

### Key Advantages

- World's slimmest portable external hard drive
- Protects your stuff with easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STCD500100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS		4.91-in L x 3.07-in W x 0.35-in D (124.8mm x 78mm x 9mm)		
PACKAGE DIMENSIONS		5.2-in L x 1.81-in W x 6.52-in D (132mm x 46mm x 165.5mm)		

## Expansion<sup>™</sup> Desktop

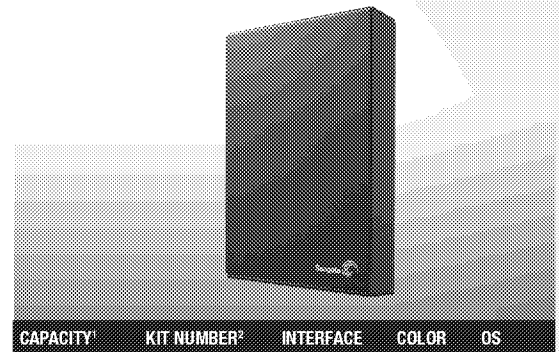
The Expansion desktop drive provides extra storage for your ever-growing collection of files.

### Key Advantages

- Simple and straightforward setup
- No software to install and nothing to configure
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

### Best-Fit Applications

- Instantly add more storage space to your computer.
- Improve performance on your computer's internal drive by freeing up space on your internal drive.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
3TB	STBV3000100	USB 3.0	● Black	PC
2TB	STBV2000100	USB 3.0	● Black	PC
1TB	STBV1000100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS		7.07-in L x 4.65-in W x 1.48-in D (179.5mm x 118mm x 37.5mm)		
PACKAGE DIMENSIONS		9.09-in L x 7.97-in W x 2.83-in D (231mm x 202mm x 72mm)		

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.

## Expansion™ Portable

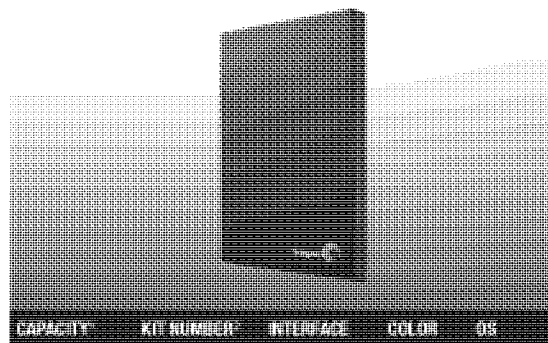
The Expansion portable drive is compact and perfect for taking large files with you on-the-go.

### Key Advantages

- Simple and straightforward setup
- Powered from the USB cable
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

### Best-Fit Applications

- Instantly add more storage space to your computer.
- Take large files with you when you travel.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
1TB	STBX1000101	USB 3.0	● Black	PC
750GB	STBX750100	USB 3.0	● Black	PC
500GB	STBX500100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS (1TB)	5.04-in L x 3.51-in W x 0.87-in D (128.1mm x 89.1mm x 22mm)			
PRODUCT DIMENSIONS (500GB)	4.81-in L x 3.19-in W x 0.61-in D (122.3mm x 81.1mm x 15.5mm)			

## GoFlex Satellite™

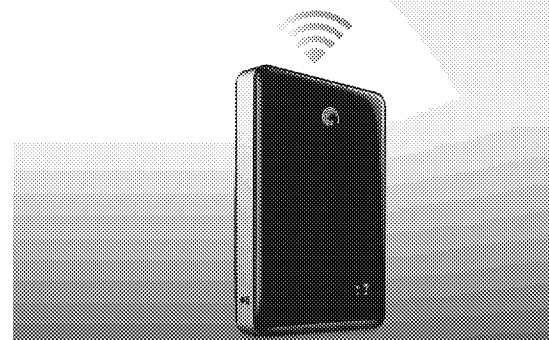
With GoFlex Satellite mobile wireless storage, you can take your media library with you. Stream it to your iPad or Android tablet.

### Key Advantages

- Take your media library with you on the go
- Stream media with up to 3 Wi-Fi enabled devices at the same time
- Automatically sync media and documents from your PC or Mac computer
- Up to 5 hours battery life<sup>3</sup>

### Best-Fit Applications

- Store and carry movies and other media on the go.
- Share media with others.
- Works with iPad or Android tablet



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
500GB	STBF500101	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	4.72-in L x 3.54-in W x 0.87-in D (120mm x 90mm x 22mm)			
PACKAGE DIMENSIONS	6.30-in L x 6.69-in W x 2.13-in D (160mm x 170mm x 54mm)			

# GoFlex<sup>®</sup> Home

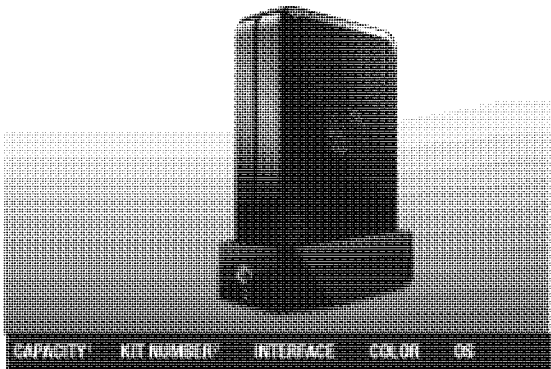
The GoFlex Home network storage system allows you to create secure in-home cloud storage for multiple computers in the home.

### Key Advantages

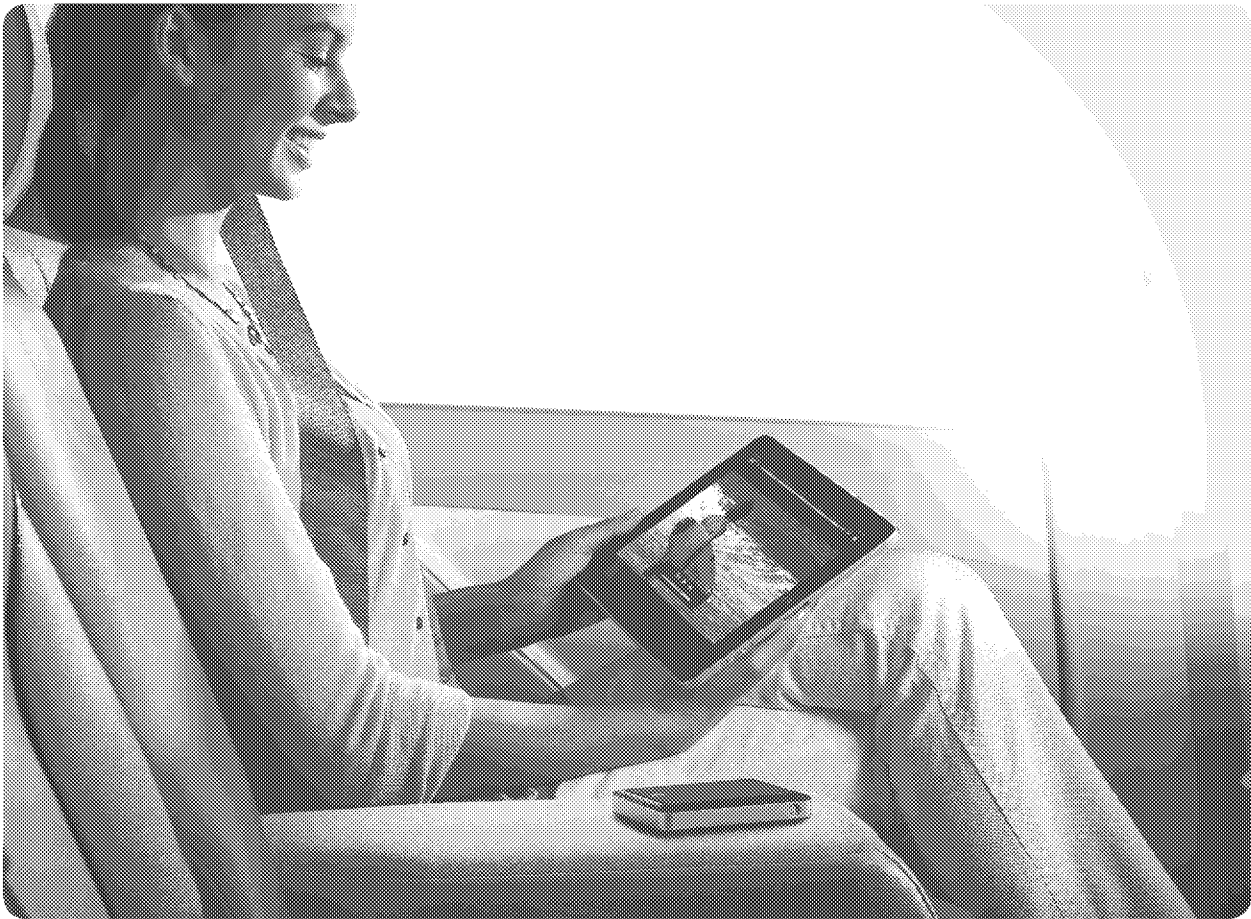
- Connects to your WiFi router
- Simple setup in just minutes
- Automatic and continuous backup
- Easily update storage capacity or plug in external drives—no tools required.

### Best-Fit Applications

- Back up multiple home PC and Mac computers.
- Store files in a central location.
- Access files from computers and mobile devices over the Internet.
- Stream media to game consoles and media players.
- Share a USB printer with all computers in the home.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
3TB	STAM3000100	SATA/GigE	Black	PC, Mac
2TB	STAM2000100	SATA/GigE	Black	PC, Mac
1TB	STAM1000100	SATA/GigE	Black	PC, Mac
PRODUCT DIMENSIONS	3.13-in L x 5.31-in W x 6.75-in D (80mm x 135mm x 171mm)			
PACKAGE DIMENSIONS	10.04-in L x 3.07-in W x 7.64-in D (255mm x 78mm x 194mm)			



<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.  
<sup>3</sup> Exact battery life subject to product model, normal usage conditions and configurations.



# BlackArmor® NAS 440/400

A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations

## Key Advantages

- BlackArmor NAS 440 models include four drives to increase capacity and take advantage of RAID 5/10 options.
- BlackArmor NAS 400 model available without pre-installed drives for maximum flexibility.
- Designed for small business to provide optimum uptime and data integrity
- User-configurable RAID 0/1/5/10 and JBOD
- Continuous and automatic full-system backup for network connected workstations<sup>3</sup>
- Hot-swappable, user-serviceable drives—no tools required

## Best-Fit Applications

- Store and access files from a central, secure location.
- Access and manage files remotely.
- Back up or move files to a secondary storage device.
- Automatically perform full-system backups on network-connect PCs.
- Share a USB printer with network-connected PCs and Macs.
- Encrypt individual files to entire volumes of data.
- Stream media with DLNA or iTunes.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
12TB	STAU12000100	Gigabit Ethernet	● Black	PC, Mac
8TB	ST380005SHA10G-RK	Gigabit Ethernet	● Black	PC, Mac
4TB	ST340005SHA10G-RK	Gigabit Ethernet	● Black	PC, Mac
---	STAR401	Gigabit Ethernet	Black	PC, Mac
PRODUCT DIMENSIONS	6.30-in W x 8.15-in H x 10.59-in D (160.00mm x 207.00mm x 269.00mm)			
PACKAGE DIMENSIONS	9.29-in W x 9.50-in H x 14.37-in D (236.00mm x 241.30mm x 365.00mm)			

# BlackArmor® NAS 220

A small-business-specific network attached storage solution designed for centralized storage and data backup for up to 20 PCs

## Key Advantages

- Automatic data mirroring with RAID 1
- Protect network-connected PCs with incremental and full-system, automatic backup<sup>3</sup>
- Functions as FTP server for remote access
- Includes two reliable, user-replaceable drives
- Secure files with hardware-based encryption.

## Best-Fit Applications

- Central, secure file storage and access
- Access and manage files remotely.
- Share a printer with connected PCs and Macs.

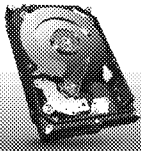
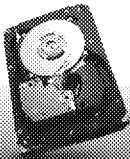







CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
6TB	STAV6000100	Gigabit Ethernet	● Black	PC, Mac
4TB	ST340005LSA10G-RK	Gigabit Ethernet	● Black	PC, Mac
2TB	ST320005LSA10G-RK	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	4.09-in W x 7.79-in H x 7.40-in D (104.00mm x 197.80mm x 188.00mm)			
PACKAGE DIMENSIONS	10.90-in W x 6.13-in H x 11.00-in D (276.86mm x 155.70mm x 279.40mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to hard drive capacity.  
<sup>2</sup> U.S. model numbers shown.  
<sup>3</sup> Includes 10 software licenses; additional licenses available at [www.seagate.com](http://www.seagate.com).

# Internal Storage

## At-a-Glance Product Comparison

	DESKTOP	ENTERPRISE		
3.5-inch				
	<b>Barracuda®</b>	<b>Cheetah® 15K</b>	<b>Constellation® ES.3</b>	<b>Constellation ES.2</b>
BUSINESS NEED	Mainstream	Performance	Mainstream	
USE THIS DRIVE FOR	Desktop compute where choice in capacity and cache options to provide design flexibility is important	High-capacity, compute-intensive requirements demanding high performance and availability	Bulk-data applications requiring reliable, highest-capacity storage, efficiency and enterprise-class reliability	
ENCRYPTION MODELS AVAILABLE		X	X	X
LEARN MORE	Page 18	Page 29	Page 30	Page 31

	LAPTOP		
2.5-inch			
	<b>Momentus® XT</b>	<b>Momentus</b>	<b>Momentus Thin</b>
BUSINESS NEED	Performance	Mainstream	Thin (7mm z-ht.)
USE THIS DRIVE FOR	The ultimate mobile computing experience, with SSD-like performance for all applications and OS environments	Laptop PCs where the lowest power consumption, silent acoustics and the highest quality is always expected	Slim computing devices such as thin laptops and netbooks, where z-height makes all the difference
ENCRYPTION MODELS AVAILABLE		X	X
LEARN MORE	Page 22	Page 23	Page 24

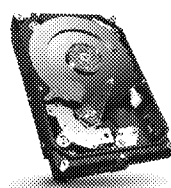
ENTERPRISE		VIDEO STORAGE	
			
Constellation ES	Constellation CS	SV35 Series™	Pipeline® HD
Mainstream	Low Power	Surveillance	DVR
Maximum-capacity enterprise servers and storage arrays requiring enterprise-class reliability		DVR systems where reliable, low-power, purpose-built storage is required for video streaming applications	
X			
Page 31		Page 36	
Page 32		Page 36	
ENTERPRISE			ENTERPRISE SSD
			
Savvio® 15K	Savvio 10K	Constellation 2™	Pulsar 2™
Performance	Mainstream	Low Power	Mainstream
Compute-intensive data requirements demanding the highest performance density and availability		Enterprise environments requiring MLC-enabled, high-capacity SSD with data integrity and drive endurance	
X		X	
Page 29		Page 33	
Page 28		Page 32	

# Desktop Storage Solutions

Seagate has a distinguished history in consistently delivering innovative technologies, super-sized capacities, low power and blazing-fast performance. Seagate desktop drives offer excellent performance at all levels.

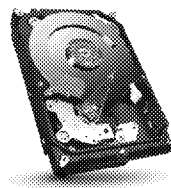


## Product Comparison



	BARRACUDA® 3.5-INCH INTERNAL KIT	BARRACUDA
Application	Mainstream	Mainstream and Performance
Description	The fast, powerful and easy way to upgrade or add storage capacity to desktop computers	Tuned performance for low-power, mainstream and high-performance desktop computing
Form Factor	3.5 inch	3.5 inch
Performance	7200 RPM	7200 RPM
Reliability (AFR)	<1%	<1%
Max. Ext. Transfer Rate	300MB/s to 600MB/s	600MB/s
Capacity <sup>1</sup>	500GB to 3TB	250GB to 3TB
Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 6Gb/s
Cache	16MB to 64MB	16MB to 64MB
Power (Idle)		4.60W 3.36W to 5.40W (Idle2)

## Feature Comparison



	MAINSTREAM	MAINSTREAM AND PERFORMANCE
Product	Barracuda 3.5-Inch Internal Kit	Barracuda
SATA Interface	X	X
Sustainable Technology	X	X
Best-in-Class Performance		X
Capacity Leadership	X	X
Quiet Acoustics	X	
DiscWizard™ Installation Software	X	X
Compatible with Windows 7 <sup>2</sup>	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 7, visit <http://www.microsoft.com/windows/compatibility/windows-7/en-us/Search.aspx?type=hardware&se=Seagate>



## Barracuda®

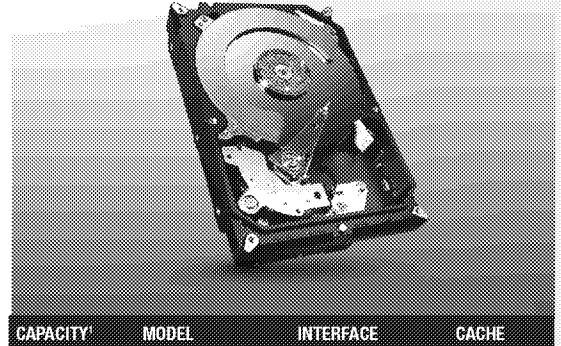
Seagate Barracuda drives give you the Power of One with 1TB-per-disk technology and one drive platform for every capacity and application.

### Key Advantages

- Up to 3TB capacity with 7200-RPM performance
- AcuTrac™ and OptiCache™ technologies deliver dependable overall performance.
- Seagate SmartAlign™ technology provides simple migration to Advanced Format 4K sectors.
- Free Seagate DiscWizard™ software

### Best-Fit Applications

- Desktop or all-in-one PCs and home servers
- PC-based gaming systems
- Desktop RAID
- Direct-attached external storage devices (DAS)
- Network-attached storage devices (NAS)



CAPACITY¹	MODEL	INTERFACE	CACHE
3TB	ST3000DM001	SATA 6Gb/s NCQ	64MB
2TB	ST2000DM001	SATA 6Gb/s NCQ	64MB
1TB	ST1000DM003	SATA 6Gb/s NCQ	64MB
500GB	ST500DM002	SATA 6Gb/s NCQ	16MB
320GB	ST320DM000	SATA 6Gb/s NCQ	16MB
250GB	ST250DM000	SATA 6Gb/s NCQ	16MB

# Barracuda® 3.5-Inch Internal Kit

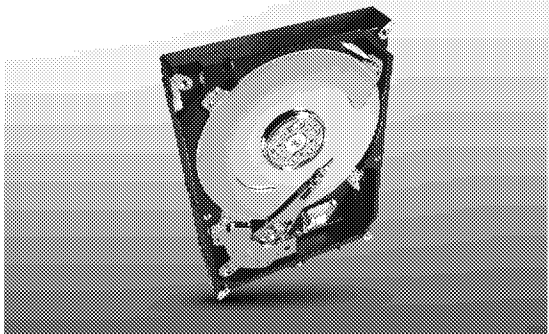
Seagate 3.5-inch internal drives are the fast, powerful, and easy way to upgrade or add storage capacity to desktop computers.

## Key Advantages

- Quiet, ultra-high performance
- DiscWizard™ software makes installation a snap
- Built-in self-monitoring technology helps ensure maximum reliability

## Best-Fit Applications

- Gaming PCs
- Workstations
- High-end PCs
- Desktop RAID
- Mainstream/office PCs



CAPACITY¹	KIT NUMBER²	RPM	INTERFACE
3TB	STBD3000100	7200	SATA 6Gb/s
2TB	STBD2000101	7200	SATA 6Gb/s
1TB	ST310005N1A1AS-RK	7200	SATA 6Gb/s
500GB	ST3500641AS-RK	7200	SATA 3Gb/s
PACKAGE DIMENSIONS	7.38-in L x 5.88-in W x 2.88-in D (187mm x 149mm x 73mm)		

¹ One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
² U.S. model numbers shown.

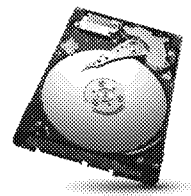
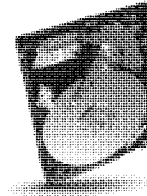
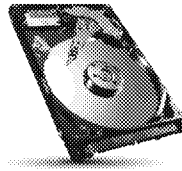
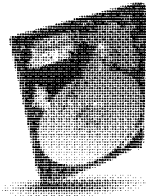


# Laptop Storage Solutions

Seagate laptop drives address every mobile market need, delivering superior performance, reliability and value. Feature-rich with innovative options, the Seagate laptop lineup also includes self-encryption and FIPS 140-2 validated models.

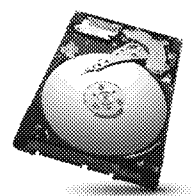
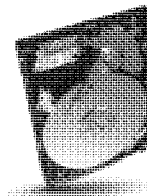
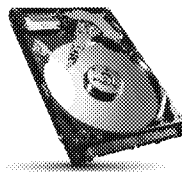
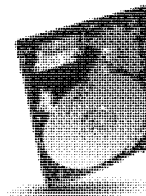


## Product Comparison



	MOMENTUS® 2.5-INCH INTERNAL KIT	MOMENTUS XT	MOMENTUS	MOMENTUS THIN
Application	Mainstream and Performance	Extreme Performance	Mainstream	Slim Computing
Description	A complete upgrade kit to transform your system to high performance or just add capacity	Solid state hybrid drives deliver SSD-like performance without sacrificing capacity	The best combination of capacity, mobility and durability in a laptop hard drive	The world's thinnest 2.5-inch drive for slim laptops and netbooks
Form Factor	2.5 inch	2.5 inch	2.5 inch	7mm, 2.5 inch
Performance	5400 RPM to 7200 RPM	7200 RPM	5400 RPM to 7200 RPM	5400 RPM to 7200 RPM
Reliability (AFR)	0.40% to 0.50%	0.50%	0.48%	0.48%
Max. Ext. Transfer Rate	300MB/s to 600MB/s	300MB/s to 600MB/s	300MB/s	300MB/s
Capacity <sup>1</sup>	250GB to 1TB	500GB to 750GB	250GB to 750GB	250GB and 300GB
Interface	SATA 6Gb/s	SATA 3Gb/s, SATA 6Gb/s	SATA 3Gb/s	SATA 3Gb/s
Cache	8MB to 32MB	32MB	8MB to 16MB	16MB
Power (idle)		0.8W to 1.1W	0.67W to 0.81W	0.45W to 0.66W

## Feature Comparison



	MAINSTREAM AND PERFORMANCE	EXTREME PERFORMANCE	MAINSTREAM	SLIM COMPUTING
Product	Momentus 2.5-Inch Internal Kit	Momentus XT	Momentus	Momentus Thin
SATA Interface	X	X	X	X
Lowest Acoustics			X	X
Lowest Power			X	X
Self-Encrypting Drive			X	X
Drop Sensor Options			X	
Solid State Hybrid	X	X		
Compatible with Windows 7 <sup>2</sup>	X	X	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 7, visit <http://www.microsoft.com/windows/compatibility/windows-7/en-us/Search.aspx?type=hardware&se=Seagate>

# Momentus® XT

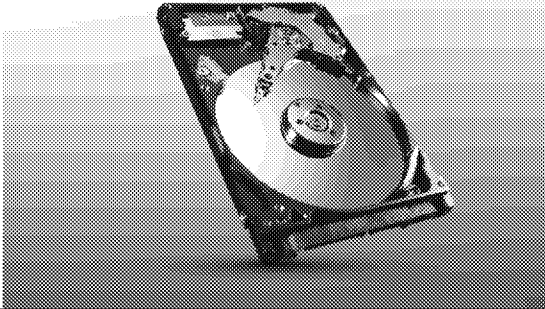
The Seagate Momentus XT solid state hybrid drive enables laptop PC users to enjoy solid state performance without sacrificing capacity.

## Key Advantages

- Boots and performs like an SSD<sup>7</sup>
- Up to 3x faster than a traditional HDD<sup>7</sup>
- SATA 6Gb/s with NCQ for interface speed
- All-in-one design for simplicity and ease of installation
- Works in any laptop or PC, any OS and any application
- Backed by a 3-year limited warranty

## Best-Fit Applications

- Laptops and mobile workstations
- Desktop and tower workstations
- High-performance laptop and desktop gaming systems
- Small form factor all-in-one PCs



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
750GB	ST750LX003	SATA 6Gb/s	32MB
500GB	ST95005620AS	SATA 3Gb/s	32MB

## Momentum®

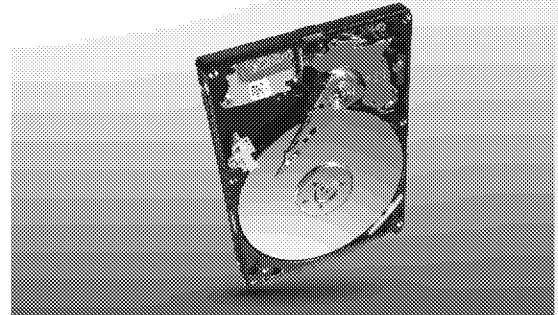
The Seagate Momentum drive offers the world's most feature-rich 2.5-inch family of storage for laptops and external enclosures.

### Key Advantages

- Innovative options and features—the power to transform from ordinary to extraordinary
- 7200 RPM delivers a constant high-performance boost.
- 5400 RPM enables affordable, low-power and high-capacity drives for external enclosures.
- Self-Encrypting Drive options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification<sup>4</sup> are government-approved for the U.S. and Canadian governments.
- G-Force Protection™ technology can help keep your data recoverable after a fall, even if your laptop doesn't survive.
- Seagate Smartalign™ technology provides a transition to 4K sectors without the need for software utilities.

### Best-Fit Applications

- Mainstream and high-performance laptops
- External storage solutions, boxes
- Industrial applications requiring a small form factor



CAPACITY <sup>1</sup>	7200-RPM MODEL	INTERFACE	CACHE
750GB	ST9750420AS <sup>3</sup>	SATA 3Gb/s	16MB
500GB	ST9500423AS <sup>3</sup>	SATA 3Gb/s	16MB
500GB	ST9500420ASG <sup>2</sup>	SATA 3Gb/s	16MB
500GB	ST9500421AS <sup>5</sup>	SATA 3Gb/s	16MB
500GB	ST9500422AS <sup>6</sup>	SATA 3Gb/s	16MB
320GB	ST9320423AS	SATA 3Gb/s	16MB
320GB	ST320LT023 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250410AS	SATA 3Gb/s	16MB
250GB	ST250LT021 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250410ASG <sup>2</sup>	SATA 3Gb/s	16MB
250GB	ST9250411AS <sup>5</sup>	SATA 3Gb/s	16MB
250GB	ST9250412AS <sup>3,6</sup>	SATA 3Gb/s	16MB

CAPACITY <sup>1</sup>	5400-RPM MODEL	INTERFACE	CACHE
500GB	ST9500325AS	SATA 3Gb/s	8MB
500GB	ST9500325ASG <sup>2</sup>	SATA 3Gb/s	8MB
500GB	ST9500327AS <sup>5</sup>	SATA 3Gb/s	8MB
320GB	ST9320325AS	SATA 3Gb/s	8MB
320GB	ST320LT022 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250315AS	SATA 3Gb/s	8MB
250GB	ST250LT020 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250317AS <sup>5</sup>	SATA 3Gb/s	8MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Drive with G-Force Protection™ feature.

<sup>3</sup> Advanced Format (4K) drive with SmartAlign™ technology requires realignment conditions.

<sup>4</sup> 7mm z-height expanded to 9.5mm enables compatibility with standard laptop chassis.

<sup>5</sup> Self-Encrypting Drive model.

<sup>6</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/compro/documents/140-1/140fword.htm>.

<sup>7</sup> Performance may vary depending on user's hardware configuration and operating system. Testing performed on a Momentum XT 750GB 5400.

# Momentum® Thin

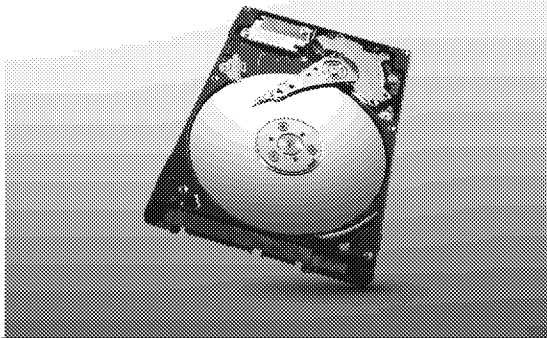
The 7mm, 2.5-inch drive enables slim computing for all types of mobile computing, from laptops to netbooks to smaller desktop PCs.

## Key Advantages

- 7mm z-height form factor enables thin chassis design for all segments of laptop computing.
- Seagate SmartAlign™ technology provides a transition to 4K sectors without the need for software utilities.
- Self-Encrypting Drive options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification<sup>3</sup> are government-approved for the U.S. and Canadian governments.

## Best-Fit Applications

- Thin entry-level laptop PCs
- Thin high-end netbooks
- Thin ultraportables
- Slim CE devices



CAPACITY <sup>1</sup>	7200-RPM MODEL	INTERFACE	CACHE
320GB	ST320LT007	SATA 3Gb/s	16MB
320GB	ST320LT014 <sup>2</sup>	SATA 3Gb/s	16MB
320GB	ST320LT009 <sup>2,3</sup>	SATA 3Gb/s	16MB
250GB	ST250LT007	SATA 3Gb/s	16MB
250GB	ST250LT014 <sup>2</sup>	SATA 3Gb/s	16MB
250GB	ST250LT009 <sup>2,3</sup>	SATA 3Gb/s	16MB

CAPACITY <sup>1</sup>	5400-RPM MODEL	INTERFACE	CACHE
500GB	ST500LT025 <sup>2,4</sup>	SATA 3Gb/s	16MB
500GB	ST500LT015 <sup>2,4</sup>	SATA 3Gb/s	16MB
500GB	ST500LT012	SATA 3Gb/s	16MB
320GB	ST320LT020	SATA 3Gb/s	16MB
320GB	ST320LT012 <sup>4</sup>	SATA 3Gb/s	16MB
250GB	ST250LT003	SATA 3Gb/s	16MB
250GB	ST250LT012 <sup>4</sup>	SATA 3Gb/s	16MB



## Momentum® 2.5-Inch Internal Kit

Seagate 2.5-inch internal drives deliver vast amounts of storage for adding capacity or upgrading drives in laptop computers.

### Key Advantages

- Built for mobility
- Preserves battery life
- Large data cache
- Outstanding performance
- Momentum XT solid state hybrid model offers SSD-like performance with the capacity of a hard drive.

### Best-Fit Applications

- Replacement laptop drives
- Laptop storage upgrades
- High-end laptops and workstations



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	RPM	INTERFACE
1TB	STBD1000100	5400	SATA 3Gb/s
500GB	ST905003N3A1AS-RK	7200	SATA 3Gb/s
500GB	ST905003N1A1AS-RK	5400	SATA 3Gb/s
250GB	ST90250N1A1AS-RK	5400	SATA 3Gb/s
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		

MOMENTUS XT MODEL			
750GB	STBD750100	7200	SATA 6Gb/s
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Energizing Drive models may require TCG-compliant host or controller support.

<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://www.nist.gov/groups/ST/comm/documents/140-1/1401vend.htm>

<sup>4</sup> SmartAlign technology is not available on this model.

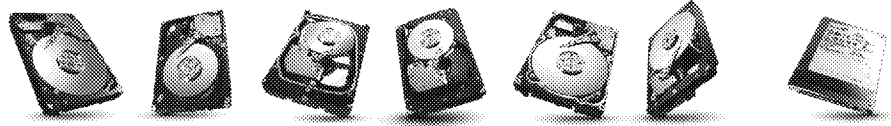
<sup>5</sup> U.S. model numbers shown.

# Enterprise Storage Solutions

Seagate has the enterprise storage expertise as well as the global presence, processes and resources to consistently support small or medium businesses and run a large data center with the industry's highest-quality enterprise storage products, including FIPS 140-2 validated models.



## Product Comparison



	SAVVIO®	CHEETAH®	CONSTELLATION®	PULSAR®
Application	SFF Performance and Mainstream	LFF Performance	High Capacity and Low Power	Mainstream SSD
Description	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 2.5-inch form factor	Highest-performing, highly reliable 15K-RPM enterprise hard drives in a 3.5-inch form factor	High-capacity, lowest-power, reliable 7200-RPM enterprise hard drive in both 2.5- and 3.5-inch form factors	Performance, data integrity and drive endurance in an enterprise solid state drive
Form Factor	2.5-inch	3.5-inch	2.5-inch and 3.5-inch	2.5-inch
Performance	15K RPM and 10K RPM	15K RPM	7200 RPM	MLC and SLC
Reliability (AFR)	0.44%	0.55%	0.62% and 1.1%	0.44%
Capacity <sup>1</sup>	300GB to 900GB	300GB to 600GB	250GB to 3TB	100GB to 800GB
Power (Idle)	3.0W to 4.4W	8.74W to 11.68W	2.52W to 7.7W	3.47W to 5.92W
Interface	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, SATA 6Gb/s	6Gb/s SAS, SATA 6Gb/s
Limited Warranty <sup>4</sup>	5 years	5 years	3 years and 5 years	5 years

## Feature Comparison



	2.5-Inch Mission Critical		3.5-Inch Mission Critical	2.5-Inch Nearline	3.5-Inch Nearline	Mainstream SSD
Product	Savvio 15K	Savvio 10K	Cheetah 15K	Constellation	Constellation ES Constellation CS	Pulsar.2
Best-in-Class Performance	X	X	X	X	X	
Capacity Leadership		X	X		X	X
Vibration Tolerance for Multi-Drive Stabilization	X	X	X	X	X	
6Gb/s SAS Interface	X	X	X	X	X	X
4Gb/s FC Interface		X	X			
6Gb/s SATA Interface				X	X	X
Best-in-Class Power Usage		X		X	X	
PowerChoice™ Optimized Idle Power Settings		X		X	X	
Self-Encrypting Drive (SED) <sup>2</sup>	X	X	X	X	X	X
FIPS 140-2 SED <sup>2,3</sup>	X	X	X	X	X	

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Encrypting Drive models may require TCG-compliant host or controller support.

<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/consp/documents/140-1/1401vend.htm>.

<sup>4</sup> Warranty terms may vary based on usage. Consult your Seagate sales representative for warranty terms and conditions.



# Savvio® 10K

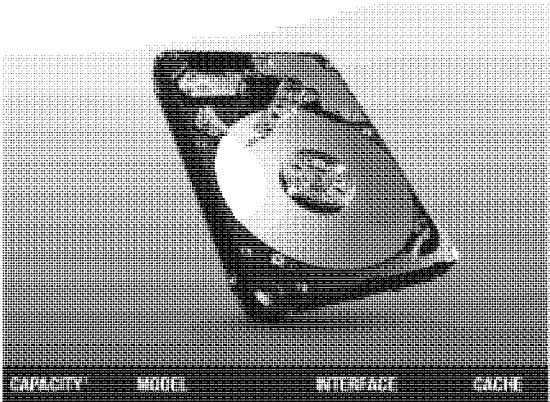
Seagate Savvio 10K drives deliver the optimal balance of capacity, performance and power in a 10K-RPM, 2.5-inch enterprise drive.

### Key Advantages

- Highest-capacity enterprise SFF hard drive (up to 900GB)
- PowerChoice™ technology reduces power consumption.
- First SFF 10K-RPM drive to support 4Gb/s FC
- Protection Information (PI) option detects corruption of data in flight between the host system and the drive<sup>5</sup>
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Mission-critical servers and external storage arrays
- Power- and space-constrained data centers
- Compliance or data security initiatives



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
900GB	ST900MM0026 <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST900MM0036 <sup>2,4</sup>	6Gb/s SAS	64MB
900GB	ST9900805SS	6Gb/s SAS	64MB
900GB	ST9900705SS <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST9900605SS <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST9900805FC	4Gb/s FC	64MB
600GB	ST600MM0026 <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600205SS	6Gb/s SAS	64MB
600GB	ST9600105SS <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600005SS <sup>2,3</sup>	6Gb/s SAS	64MB
600GB	ST9600205FC	4Gb/s FC	64MB
450GB	ST450MM0026 <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450405SS	6Gb/s SAS	64MB
450GB	ST9450305SS <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450205SS <sup>2,3</sup>	6Gb/s SAS	64MB
450GB	ST9450405FC	4Gb/s FC	64MB
300GB	ST300MM0026 <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300605SS	6Gb/s SAS	64MB
300GB	ST9300505SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300405SS <sup>2,3</sup>	6Gb/s SAS	64MB
300GB	ST9300605FC	4Gb/s FC	64MB

## Savvio® 15K

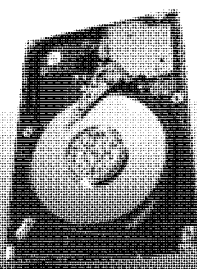
The 2.5-inch Seagate Savvio 15K hard drive provides the world's highest performance and reliability while delivering ultra-low power consumption.

### Key Advantages

- Stores twice the amount of Tier 1 data without increasing drive count
- Enables Tier 1 applications to process transactions more quickly
- Reduces system complexity and operating costs
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- High-performance enterprise servers and storage arrays
- Transaction-intensive database applications
- Blade, rack and tower servers
- Security compliance-driven IT organizations



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
300GB	ST9300653SS	6Gb/s SAS	64MB
300GB	ST9300553SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300453SS <sup>2,3</sup>	6Gb/s SAS	64MB
146GB	ST9146853SS	6Gb/s SAS	64MB
146GB	ST9146753SS <sup>2</sup>	6Gb/s SAS	64MB
146GB	ST9146653SS <sup>2,3</sup>	6Gb/s SAS	64MB
146GB	ST9146852SS	6Gb/s SAS	16MB
146GB	ST9146752SS <sup>2</sup>	6Gb/s SAS	16MB
146GB	ST9146652SS <sup>2,3</sup>	6Gb/s SAS	16MB
73GB	ST973452SS	6Gb/s SAS	16MB
73GB	ST973352SS <sup>2</sup>	6Gb/s SAS	16MB
73GB	ST973252SS <sup>2,3</sup>	6Gb/s SAS	16MB

## Cheetah® 15K

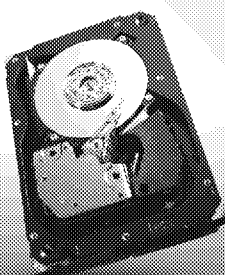
The Seagate Cheetah 15K drive provides the highest capacity, performance and reliability in 3.5-inch mission-critical storage.

### Key Advantages

- Third-generation perpendicular recording
- Sustained data rate of up to 204MB/s
- Industry's highest 3.5-inch drive reliability
- Powertrim™ technology optimizes power consumption
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Business and transaction processing
- Email and decision support
- Storage Area Networks (SAN)
- Network Attached Storage (NAS)
- Internet and e-commerce



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
600GB	ST3600057SS	6Gb/s SAS	16MB
600GB	ST3600957SS <sup>2</sup>	6Gb/s SAS	16MB
600GB	ST3600857SS <sup>2,3</sup>	6Gb/s SAS	16MB
600GB	ST3600057FC	4Gb/s FC	16MB
450GB	ST3450857SS	6Gb/s SAS	16MB
450GB	ST3450757SS <sup>2</sup>	6Gb/s SAS	16MB
450GB	ST3450657SS <sup>2,3</sup>	6Gb/s SAS	16MB
450GB	ST3450857FC	4Gb/s FC	16MB
300GB	ST3300657SS	6Gb/s SAS	16MB
300GB	ST3300557SS <sup>2</sup>	6Gb/s SAS	16MB
300GB	ST3300457SS <sup>2,3</sup>	6Gb/s SAS	16MB
300GB	ST3300657FC	4Gb/s FC	16MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Encrypting Drive models may require TCG-compliant host or controller support.

<sup>3</sup> See FIPS 140-2 Level 2 Certificates at <http://csrc.nist.gov/groups/STM/convg/documents/140-1/1402level2.html>.

<sup>4</sup> FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificates at <http://csrc.nist.gov/groups/STM/convg/validation.html#05>

<sup>5</sup> Protection Information (PI) feature requires PI-compliant host or controller support.

## Constellation® ES.3

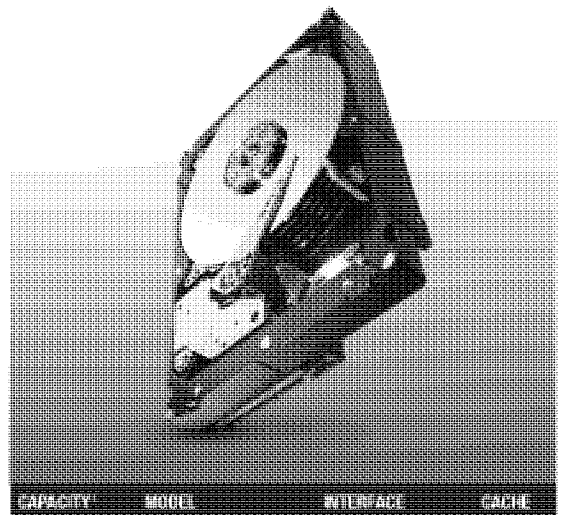
The Seagate Constellation ES.3 enterprise capacity HDD helps data centers meet the demanding growth of unstructured data.

### Key Advantages

- Highest-capacity enterprise drive for maximum density server and storage solutions
- SAS and SATA interfaces with 24x7 reliability
- Predictable 7200-RPM performance even in the most rugged multi-drive environments
- Improved power and cooling efficiencies with low power consumption and on-demand PowerChoice™ technology
- Protect your data and ease data disposal costs and management with the SED FIPS 140-2 option.<sup>4,5</sup>

### Best-Fit Applications

- High-capacity RAID storage
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000NM0033	SATA 6Gb/s	128MB
4TB	ST4000NM0053 <sup>4</sup>	SATA 6Gb/s	128MB
4TB	ST4000NM0023	6Gb/s SAS	128MB
4TB	ST4000NM0043 <sup>4</sup>	6Gb/s SAS	128MB
4TB	ST4000NM0063 <sup>4,5</sup>	6Gb/s SAS	128MB
3TB	ST3000NM0033	SATA 6Gb/s	128MB
3TB	ST3000NM0053 <sup>4</sup>	SATA 6Gb/s	128MB
3TB	ST3000NM0023	6Gb/s SAS	128MB
3TB	ST3000NM0043 <sup>4</sup>	6Gb/s SAS	128MB
3TB	ST3000NM0063 <sup>4,5</sup>	6Gb/s SAS	128MB
2TB	ST2000NM0033	SATA 6Gb/s	128MB
2TB	ST2000NM0053 <sup>4</sup>	SATA 6Gb/s	128MB
2TB	ST2000NM0023	6Gb/s SAS	128MB
2TB	ST2000NM0043 <sup>4</sup>	6Gb/s SAS	128MB
2TB	ST2000NM0063 <sup>4,5</sup>	6Gb/s SAS	128MB
1TB	ST1000NM0033	SATA 6Gb/s	128MB
1TB	ST1000NM0053 <sup>4</sup>	SATA 6Gb/s	128MB
1TB	ST1000NM0023	6Gb/s SAS	128MB
1TB	ST1000NM0043 <sup>4</sup>	6Gb/s SAS	128MB
1TB	ST1000NM0063 <sup>4,5</sup>	6Gb/s SAS	128MB

## Constellation® ES.2

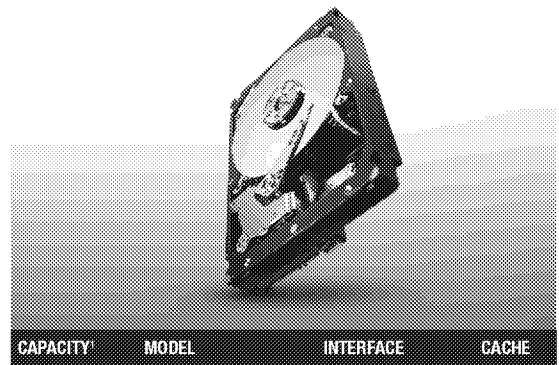
The Seagate Constellation ES.2 drive offers the highest capacities with nearline performance, enterprise-class reliability, high data integrity and data security.

### Key Advantages

- Highest-capacity enterprise drive for demanding data growth
- SAS and SATA drives designed for 24x7 reliability
- Best-in-class enhanced rotational vibration tolerance
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- High-capacity bulk-data storage
- Mainstream enterprise external storage arrays
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance
- Cloud storage



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
3TB	ST33000650NS	SATA 6Gb/s	64MB
3TB	ST33000651NS <sup>2</sup>	SATA 6Gb/s	64MB
3TB	ST33000652NS <sup>2,3</sup>	SATA 6Gb/s	64MB
3TB	ST33000650SS	6Gb/s SAS	64MB
3TB	ST33000651SS <sup>2</sup>	6Gb/s SAS	64MB
3TB	ST33000652SS <sup>2,3</sup>	6Gb/s SAS	64MB
2TB	ST32000645NS	SATA 6Gb/s	64MB
2TB	ST32000646NS <sup>2</sup>	SATA 6Gb/s	64MB
2TB	ST32000647NS <sup>2,3</sup>	SATA 6Gb/s	64MB
2TB	ST32000645SS	6Gb/s SAS	64MB
2TB	ST32000646SS <sup>2</sup>	6Gb/s SAS	64MB
2TB	ST32000647SS <sup>2,3</sup>	6Gb/s SAS	64MB

## Constellation® ES

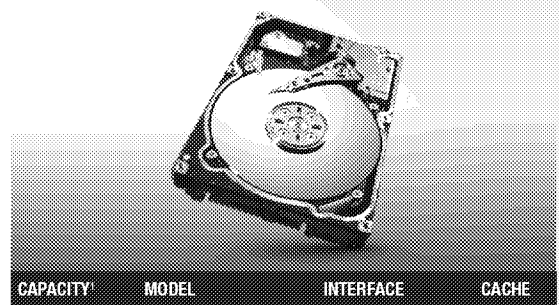
Seagate Constellation ES 3.5-inch hard drives offer the highest capacity at 2TB while providing enterprise robustness for seamless enterprise integration.

### Key Advantages

- Enterprise nearline drive designed for 24x7 operation
- Best-in-class rotational vibration tolerance
- Multi-drive firmware maximizes system availability.
- Optimal power savings with PowerChoice™ technology
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data.
- FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- High-capacity data center storage
- Mainstream enterprise external storage arrays
- Enterprise backup and restore
- Cloud storage



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
2TB	ST2000NM0011	SATA 6Gb/s	64MB
2TB	ST2000NM0031 <sup>2</sup>	SATA 6Gb/s	64MB
2TB	ST2000NM0051 <sup>2,3</sup>	SATA 6Gb/s	64MB
2TB	ST2000NM0001	6Gb/s SAS	64MB
2TB	ST2000NM0021 <sup>2</sup>	6Gb/s SAS	64MB
2TB	ST2000NM0041 <sup>2,3</sup>	6Gb/s SAS	64MB
1TB	ST1000NM0011	SATA 6Gb/s	64MB
1TB	ST1000NM0031 <sup>2</sup>	SATA 6Gb/s	64MB
1TB	ST1000NM0051 <sup>2,3</sup>	SATA 6Gb/s	64MB
1TB	ST1000NM0001	6Gb/s SAS	64MB
1TB	ST1000NM0021 <sup>2</sup>	6Gb/s SAS	64MB
1TB	ST1000NM0041 <sup>2,3</sup>	6Gb/s SAS	64MB
500GB	ST500NM0011	SATA 6Gb/s	64MB
500GB	ST500NM0031 <sup>2</sup>	SATA 6Gb/s	64MB
500GB	ST500NM0051 <sup>2,3</sup>	SATA 6Gb/s	64MB
500GB	ST500NM0001	6Gb/s SAS	64MB
500GB	ST500NM0021 <sup>2</sup>	6Gb/s SAS	64MB
500GB	ST500NM0041 <sup>2,3</sup>	6Gb/s SAS	64MB

<sup>1</sup>One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup>Seagate Instant Secure Erase Models

<sup>3</sup>DDR2 Cache

<sup>4</sup>Self-Encrypting Drives (SED) and FIPS 140-2 Validated drives are not available in all models or countries. May require TCG-compliant host or controller support.

<sup>5</sup>FIPS 140-2 in review. See FIPS 140-2 meet 2 Certification at <http://csrc.nist.gov/groups/ST/IR/comp/documents/f140-1/f1401val2011.htm#7635>

<sup>6</sup>Based on maximum use of multiple 3.5-inch HDDs in standard 4U 19-inch rack

## Constellation® CS

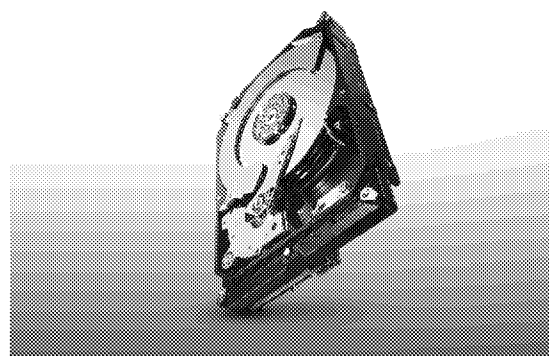
The Seagate Constellation CS enterprise value hard drive is designed for vast amounts of unstructured data in the cloud..

### Key Advantages

- Affordable storage for 24x7 cloud data center replicated environments
- High vibration tolerance for reliable performance
- Save on power and cooling costs with the lowest 3.5-inch enterprise drive operating power.
- Advanced format logical block management
- Lower TCO with Seagate Instant Secure Erase
- Maximize your cloud storage with up to 114TB per square foot.<sup>6</sup>

### Best-Fit Applications

- Cloud storage servers and arrays
- Cloud backup storage
- Direct-attached external storage devices (DAS)
- Network-attached storage devices (NAS)



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
3TB	ST3000NC002	SATA 6Gb/s	64MB <sup>3</sup>
3TB	ST3000NC002	SATA 6Gb/s	64MB <sup>3</sup>
2TB	ST2000NC001	SATA 6Gb/s	64MB <sup>3</sup>
2TB	ST2000NC002	SATA 6Gb/s	64MB <sup>3</sup>
1TB	ST1000NC001	SATA 6Gb/s	64MB <sup>3</sup>
1TB	ST1000NC002	SATA 6Gb/s	64MB <sup>3</sup>

## Constellation.2™

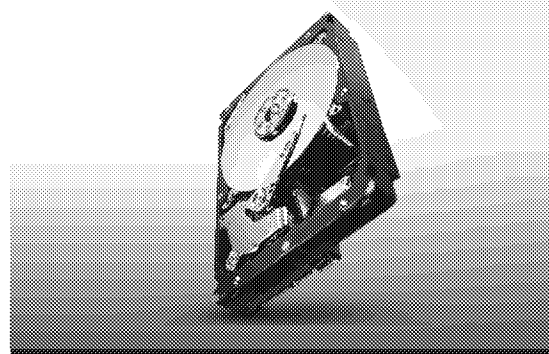
The Seagate Constellation.2 drive is the only 2.5-inch enterprise-class hard drive delivering both 1TB capacities and enterprise reliability.

### Key Advantages

- Maximizes data center footprint with up to 76TB/sq.ft.
- Energy-efficient storage at under 3.9W (idle)
- Highest nearline reliability with an MTBF of 1.4M hours
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data.
- FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Storage-hungry business applications
- Storage area networks and network attached storage
- Maximum-capacity servers and blade servers
- Rich media content storage
- Enterprise backup and restore—D2D, virtual tape
- Cloud computing



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
1TB	ST91000640NS	SATA 6Gb/s	64MB
1TB	ST91000641NS <sup>2</sup>	SATA 6Gb/s	64MB
1TB	ST91000642NS <sup>2,3</sup>	SATA 6Gb/s	64MB
1TB	ST91000640SS	6Gb/s SAS	64MB
1TB	ST91000641SS <sup>2</sup>	6Gb/s SAS	64MB
1TB	ST91000642SS <sup>2,3</sup>	6Gb/s SAS	64MB
500GB	ST9500620NS	SATA 6Gb/s	64MB
500GB	ST9500621NS <sup>2</sup>	SATA 6Gb/s	64MB
500GB	ST9500622NS <sup>2,3</sup>	SATA 6Gb/s	64MB
500GB	ST9500620SS	6Gb/s SAS	64MB
500GB	ST9500621SS <sup>2</sup>	6Gb/s SAS	64MB
500GB	ST9500622SS <sup>2,3</sup>	6Gb/s SAS	64MB
250GB	ST9250610NS	SATA 6Gb/s	64MB
250GB	ST9250611NS <sup>2</sup>	SATA 6Gb/s	64MB
250GB	ST9250612NS <sup>2,3</sup>	SATA 6Gb/s	64MB





## Pulsar.2™

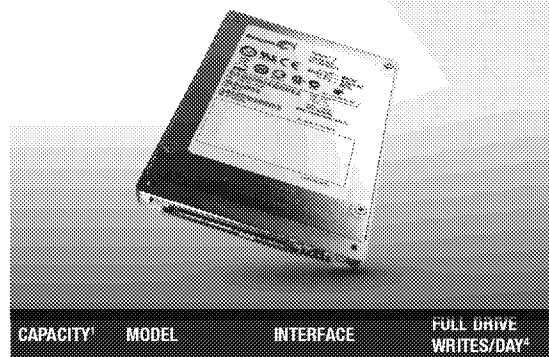
The Seagate Pulsar.2 drive delivers the price-performance, data integrity and endurance benefits for performance-hungry enterprise applications.

### Key Advantages

- Best-in-class MLC endurance (up to 10 full drive writes/day)
- Price-performance and reliability benefits
- Protects against unintended data change or loss—ensuring data integrity
- Provides the same feature set to look, feel and act like an enterprise hard drive—reducing system complexity and operating costs

### Best-Fit Applications

- Tier 0, performance-hungry enterprise applications—virtualization, OLTP, data warehousing and cloud computing
- Blade servers, general servers and direct-attached storage
- Enterprise architectures using auto-tiering



CAPACITY <sup>1</sup>	MODEL	INTERFACE	FULL DRIVE WRITES/DAY <sup>2</sup>
800GB	ST800FM0002	6Gb/s SAS	10
800GB	ST800FM0012 <sup>3</sup>	6Gb/s SAS	10
400GB	ST400FM0002	6Gb/s SAS	10
400GB	ST400FM0012	SATA 6Gb/s	10
200GB	ST200FM0002	6Gb/s SAS	10
200GB	ST200FM0012	SATA 6Gb/s	10
100GB	ST100FM0002	6Gb/s SAS	10
100GB	ST100FM0012	SATA 6Gb/s	10

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Encrypting Drive models may require 10GB-compliant host or controller support.

<sup>3</sup> See PPS 140-2 Level 2 Certificate at <http://www.storagelink.com/groups/61761/attachment/documents/140-1/140-1-usd.htm>.

<sup>4</sup> Data provided is based on format at 512 bytes.

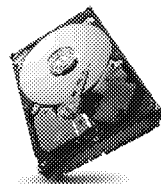
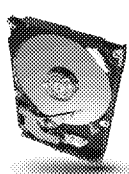
# Video Storage Solutions

## Storage solutions for DVRs and surveillance systems

Seagate has the global presence to provide the supply and support for CE integrators as well as a complete business and technology partnership for the video storage market.

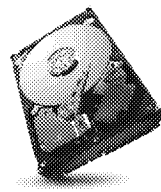


## Product Comparison



	PIPELINE HD®	SV35 SERIES™
Application	Mainstream CE-DVR	Video Surveillance
Description	Cool, quiet, low-power performance—perfect for high-definition consumer DVR applications	Optimized performance, power savings and improved reliability for video surveillance applications
Form Factor	3.5-inch	3.5-inch
Performance	Multi-room video delivery of at least ten simultaneous HD streams	7200 RPM
Reliability (AFR)	0.55%	<1%
Max. Ext. Transfer Rate	300MB/s to 600MB/s	600MB/s
Capacity¹	250GB to 2TB	1TB to 3TB
Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 6Gb/s
Cache	8MB to 64MB	64MB
Power (Idle)	2.5W to 4.5W	3.36W to 5.4W (Idle2)

## Feature Comparison



	3.5-Inch CE-DVR	Video Surveillance
Application	Pipeline HD	SV35 Series
SATA Interface	x	x
Low Power	x	
Quiet Acoustics	x	
Cool Operation	x	x
Sustainable Technology	x	
Best-in-Class Performance	x	x
Capacity Leadership	x	
24x7 Operation Capable	x	x
Extremely Low Vibration	x	

¹ One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.



## Pipeline HD®

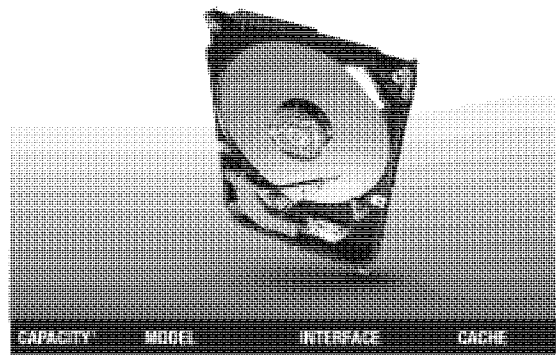
Seagate Pipeline HD drives deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

### Key Advantages

- Virtually silent streaming performance as low as 19dB
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

### Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes



CAPACITY¹	MODEL	INTERFACE	CACHE
2TB	ST2000VM003	SATA 3Gb/s	64MB
1TB	ST1000VM002	SATA 3Gb/s	64MB
500GB	ST3500312CS	SATA 3Gb/s	8MB
320GB	ST3320311CS	SATA 3Gb/s	8MB
250GB	ST3250312CS	SATA 3Gb/s	8MB

## SV35 Series™

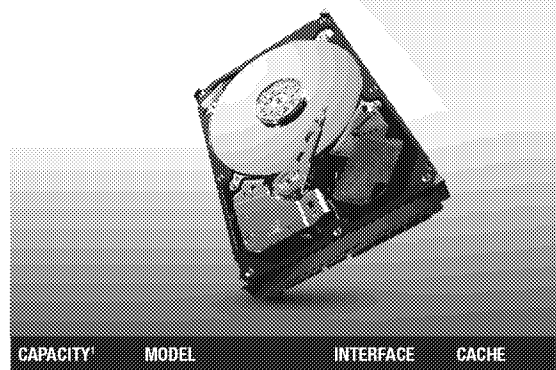
The Seagate SV35 series drives optimize performance, save power and improve reliability for video surveillance applications.

### Key Advantages

- Higher areal density for cost-effective DVR applications
- Performance-tuned for seamless video applications
- Enterprise-class reliability for 24x7 video surveillance applications
- Built-in error recovery for non-stop streaming

### Best-Fit Applications

- Video surveillance digital video recorder
- Video surveillance network digital video recorder
- Direct-attached JBOD video surveillance storage
- Network-attached JBOD video storage



CAPACITY¹	MODEL	INTERFACE	CACHE
3TB	ST3000VX000	SATA 6Gb/s	64MB
2TB	ST2000VX000	SATA 6Gb/s	64MB
1TB	ST1000VX000	SATA 6Gb/s	64MB

## Partner Resources and Benefits

The Seagate Partner Program (SPP) provides access to unique resources and benefits to help channel partners secure new opportunities and grow revenue and profitability.

As a registered SPP member, you enjoy the following exclusive features:

- Password-protected portal
- E-newsletter and regular news updates
- New product evaluation unit program
- Training and sales tools
- Priority support

**Start reaping the rewards of SPP membership—register today at [www.seagate.com/partners](http://www.seagate.com/partners)**

- Complete the online form.
- Click through and accept our standard agreement.

## Service and Support

For information regarding products and services, visit [www.seagate.com/about/contact-us/technical-support](http://www.seagate.com/about/contact-us/technical-support)

Available services include:

- Presales and Technical Support
- Global Support Services telephone numbers and business hours
- Authorized Seagate Service Centers

For information regarding Warranty Support, visit [www.seagate.com/support/warranty-and-returns](http://www.seagate.com/support/warranty-and-returns)

For information regarding Data Recovery Services, visit [services.seagate.com](http://services.seagate.com)

For Seagate OEM and Distribution partner portal, visit [www.seagate.com/partners](http://www.seagate.com/partners)

For Seagate reseller portal, visit [www.seagate.com/partners](http://www.seagate.com/partners)



Seagate Technology LLC  
10800 South De Anza Boulevard  
Cupertino, California 95014  
408-658-1000

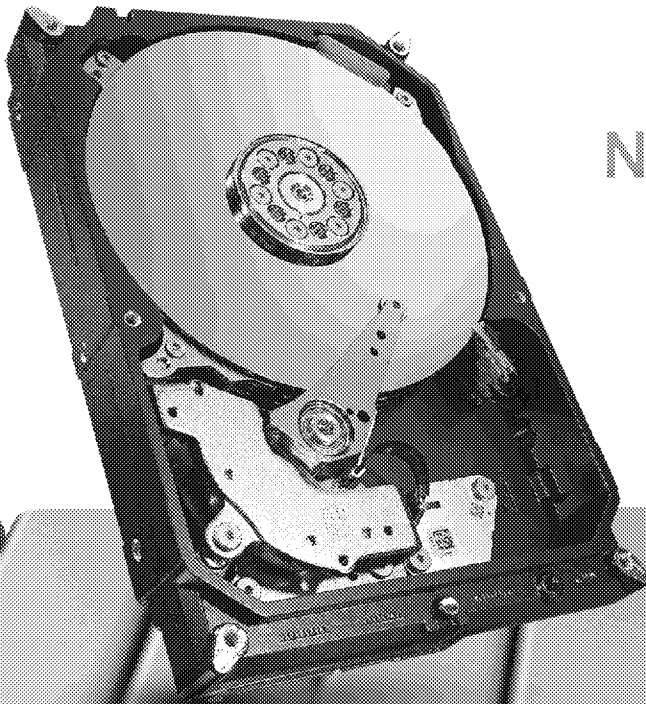
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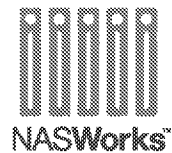


# Storage Solutions Guide

JULY 2013 | AMER



NAS performance.  
NAS capacity.  
*NAS works.*



# Seagate® Flash Products

# Flash Forward.

The absolute highest performance solutions for client and enterprise



[www.seagate.com](http://www.seagate.com)

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On the cover: Fine-tuned to address the needs of small NAS systems, NASWorks™ technology simplifies drive installation and improves reliability. Available on the Seagate NAS HDD (page 32).

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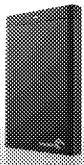
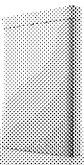
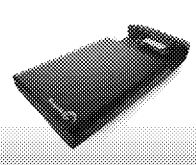


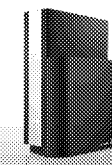
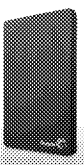

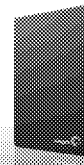
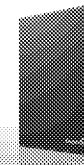
#### VIDEO STORAGE

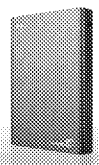
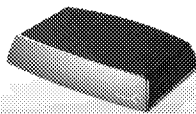
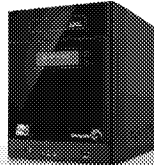


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# External Storage

## At-a-Glance Product Comparison

	BACKUP PLUS						SLIM		EXPANSION	
Direct Attached/ Portable										
	Backup Plus Portable	Backup Plus Portable for Mac	Backup Plus for Mac Portable Thunderbolt™	Backup Plus Desktop	Backup Plus Desktop for Mac	Backup Plus for Mac Desktop Thunderbolt	Slim Portable	Slim Portable for Mac	Expansion Portable	Expansion Desktop
PERFECT FOR	Protecting and sharing digital memories			Keeping your digital life safe and sound		Keeping your digital life safe and sound	Thin storage that fits—and goes—anywhere		Protecting and sharing your digital life	
DESCRIPTION	Store and back up the content on your social networks with these flexible, portable drives. PC or Mac.			These desktop drives provide the simple, one-click way to protect and share files. PC or Mac.		These desktop drives provide the simple, one-click way to protect and share files. Mac.	This ultra-thin metal design is the world's sleekest portable external hard drive. PC or Mac.		Expansion drives allow you to instantly add more storage space to your computer and take large files with you.	
LEARN MORE	Page 5	Page 6	Page 6	Page 8	Page 7	Page 7	Page 9	Page 8	Page 10	Page 9

Wireless Mobile			Network Attached				
	Wireless Plus			Central	Business Storage 4-Bay NAS	Business Storage 2-Bay NAS	Business Storage 1-Bay NAS
PERFECT FOR	Wireless storage for your tablet		PERFECT FOR	Wireless centralized home storage		Centralized storage, collaboration and backup	
DESCRIPTION	Take your media library on the go and stream it wirelessly to your iPad, Android tablet and smartphone. PC or Mac.		DESCRIPTION	This shared storage device automatically backs up multiple Macs and PCs plus streams your shared library to the connected devices in the home.	A complete network storage solution and private cloud for businesses of up to 50 employees.	A complete network storage solution and private cloud for businesses of up to 25 employees.	A complete network storage solution and private cloud for home offices.
LEARN MORE	Page 10		LEARN MORE	Page 11	Page 12	Page 13	Page 13



# External Storage Solutions

Seagate external storage solutions are sleek, dependable and ultra-portable products that let your customers automatically and continuously store digital family photos, protect critical business data, back up multiple computers on a small network, or share and store videos and music.

## Backup Plus

The Backup Plus portable drive is the simple way to protect and share your entire digital life.

### Key Advantages

- Easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Thunderbolt technology or FireWire 800 upgrade allows higher transfer speeds

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.

CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBU1000100	USB 3.0	● Black	PC, Mac
1TB	STBU1000101	USB 3.0	● Silver	PC, Mac
1TB	STBU1000102	USB 3.0	● Blue	PC, Mac
1TB	STBU1000103	USB 3.0	● Red	PC, Mac
750GB	STBU750100	USB 3.0	● Black	PC, Mac
500GB	STBU500100	USB 3.0	● Black	PC, Mac
500GB	STBU500101	USB 3.0	● Silver	PC, Mac
500GB	STBU500102	USB 3.0	● Blue	PC, Mac
500GB	STBU500103	USB 3.0	● Red	PC, Mac
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.54-in D (132mm x 46mm x 166mm)			



<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown

# Backup Plus for Mac

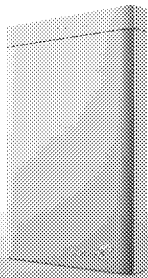
The Backup Plus portable drive for Mac is the simple way to protect and share your entire digital life.

## Key Advantages

- Mac OS and Time-Machine ready out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click.
- Easily increase transfer speeds by upgrading to Thunderbolt technology.

## Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBW1000301	USB 3.0	● Silver/ ○ White	Mac, PC
500GB	STBW500301	USB 3.0	● Silver/ ○ White	Mac, PC
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.54-in D (132mm x 46mm x 166mm)			

# Backup Plus Desktop for Mac

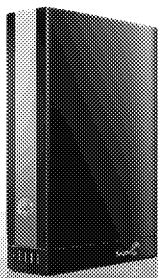
The Backup Plus desktop drive for Mac is the simple, one-click way to protect and share your entire digital life.

## Key Advantages

- Mac OS and Time Machine ready right out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click.
- Up to 3TB capacity for a lifetime of memories

## Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
3TB	STCB3000900	FireWire 800/ USB 3.0	● Black/ ● Silver	Mac, PC
2TB	STCB2000900	FireWire 800/ USB 3.0	● Black/ ● Silver	Mac, PC
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

# Backup Plus for Mac Portable Thunderbolt™


The Thunderbolt Backup Plus for Mac portable drive is everything you need to transfer, store and back up files using Thunderbolt technology.

## Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Compatible with Time Machine software
- Compatible with Thunderbolt devices
- No external power supply required

## Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gbps



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBW1000401	Thunderbolt	● Black	Mac, PC
PRODUCT DIMENSIONS	5.12-in L x 3.19-in W x 1.09-in D (130mm x 81mm x 27.8mm)			
PACKAGE DIMENSIONS	6.69-in L x 5.24-in W x 1.81-in D (170mm x 133mm x 46mm)			

# Backup Plus for Mac Desktop Thunderbolt

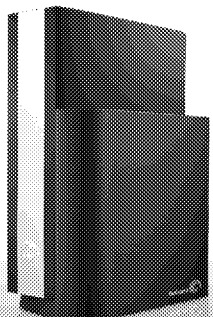
The Thunderbolt Backup Plus for Mac desktop drive is everything you need to transfer, store and back up files using Thunderbolt technology.

## Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Dual ports enable daisy-chaining up to six devices
- Compatible with Thunderbolt displays and other devices
- Compatible with Time Machine softwares

## Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gbps



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
3TB	STCB3000400	Thunderbolt	● Black	Mac, PC
PRODUCT DIMENSIONS	6.61-in L x 4.76-in W x 2.42-in D (168mm x 120.9mm x 61.4mm)			
PACKAGE DIMENSIONS	8.64-in L x 9.13-in W x 3.5-in D (219.5mm x 232mm x 89mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown



## Backup Plus Desktop

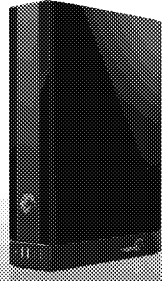
The Backup Plus desktop drive is the simple, one-click way to protect and share your entire digital life.

### Key Advantages

- Easy, flexible, built-in backup options
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Up to 4TB capacity for a lifetime of memories
- Increase transfer speeds by upgrading to Thunderbolt technology or FireWire 800.

### Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STCA4000100	USB 3.0	● Black	PC, Mac
3TB	STCA3000100	USB 3.0	● Black	PC, Mac
2TB	STCA2000100	USB 3.0	● Black	PC, Mac
1TB	STCA1000100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

## Slim

The Seagate Slim portable drive is thin, light and the easiest way yet to back up the things that are important to you.

### Key Advantages

- Just slightly thicker than an iPhone
- Protects your stuff with easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STCD500102	USB 3.0	● Black	PC, Mac
500GB	STCD500104	USB 3.0	● Silver	PC, Mac
PRODUCT DIMENSIONS	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
PACKAGE DIMENSIONS	5.59-in L x 1.22-in W x 4.06-in D (142mm x 31mm x 103mm)			

## Slim for Mac

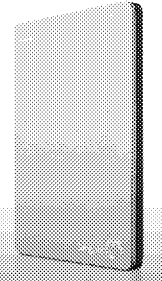
The Seagate Slim portable drive for Mac combines a thin, light form factor in a Time Machine-ready drive.

### Key Advantages

- Just slightly thicker than an iPhone
- Mac OS and Time Machine ready out of the box
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STCF500102	USB 3.0	● Silver	Mac, PC
PRODUCT DIMENSIONS	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
PACKAGE DIMENSIONS	5.59-in L x 1.22-in W x 4.06-in D (142mm x 31mm x 103mm)			

## Expansion

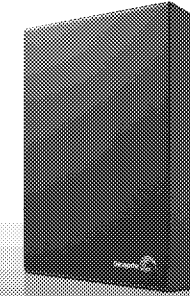
The Expansion desktop drive provides extra storage for your ever-growing collection of files.

### Key Advantages

- Simple and straightforward setup
- No software to install and nothing to configure
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

### Best-Fit Applications

- Instantly add more storage space to your computer.
- Improve performance on your computer's internal drive by freeing up space on your internal drive.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STBV4000100	USB 3.0	● Black	PC
3TB	STBV3000100	USB 3.0	● Black	PC
2TB	STBV2000100	USB 3.0	● Black	PC
1TB	STBV1000100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS	7.07-in L x 4.65-in W x 1.48-in D (179.5mm x 118mm x 37.5mm)			
PACKAGE DIMENSIONS	9.09-in L x 7.97-in W x 2.83-in D (231mm x 202mm x 72mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.

## Expansion

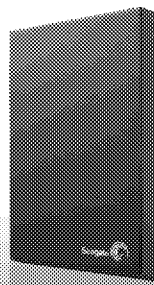
The Expansion portable drive is compact and perfect for taking large files with you on-the-go.

### Key Advantages

- Simple and straightforward setup
- Powered from the USB cable
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

### Best-Fit Applications

- Instantly add more storage space to your computer.
- Take large files with you when you travel.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBX1000101	USB 3.0	● Black	PC
750GB	STBX750100	USB 3.0	● Black	PC
500GB	STBX500100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS (1TB)	5.04-in L x 3.51-in W x 0.87-in D (128.1mm x 89.1mm x 22mm)			
PRODUCT DIMENSIONS (500GB)	4.81-in L x 3.19-in W x 0.61-in D (122.3mm x 81.1mm x 15.5mm)			
PACKAGE DIMENSIONS	5.28-in L x 6.69-in W x 1.89-in D (134mm x 170mm x 48mm)			

## Wireless Plus

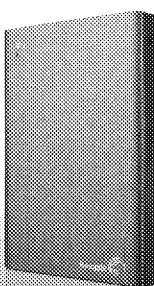
With Wireless Plus mobile device storage, you can take your media library with you. Stream it to your iPad or Android tablet.

### Key Advantages

- Take your media library with you on the go
- Share media with up to eight Wi-Fi enabled devices at the same time
- Use anywhere, without an Internet connection
- Up to 10 hours battery life<sup>3</sup>

### Best-Fit Applications

- Store and carry movies and other media on the go.
- Share media with others.
- Works with iPad or Android tablets and smartphones



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STCK1000100	USB 3.0	● Grey	PC, Mac
PRODUCT DIMENSIONS	5.00-in L x 3.50-in W x 0.78-in D (127mm x 89mm x 19.9mm)			
PACKAGE DIMENSIONS	2.00-in L x 6.02-in W x 7.16-in D (51mm x 153mm x 182mm)			

## Central

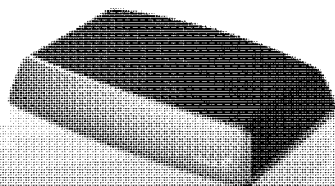
The Central shared network storage system allows you to create secure in-home cloud storage for multiple computers in the home.

### Key Advantages

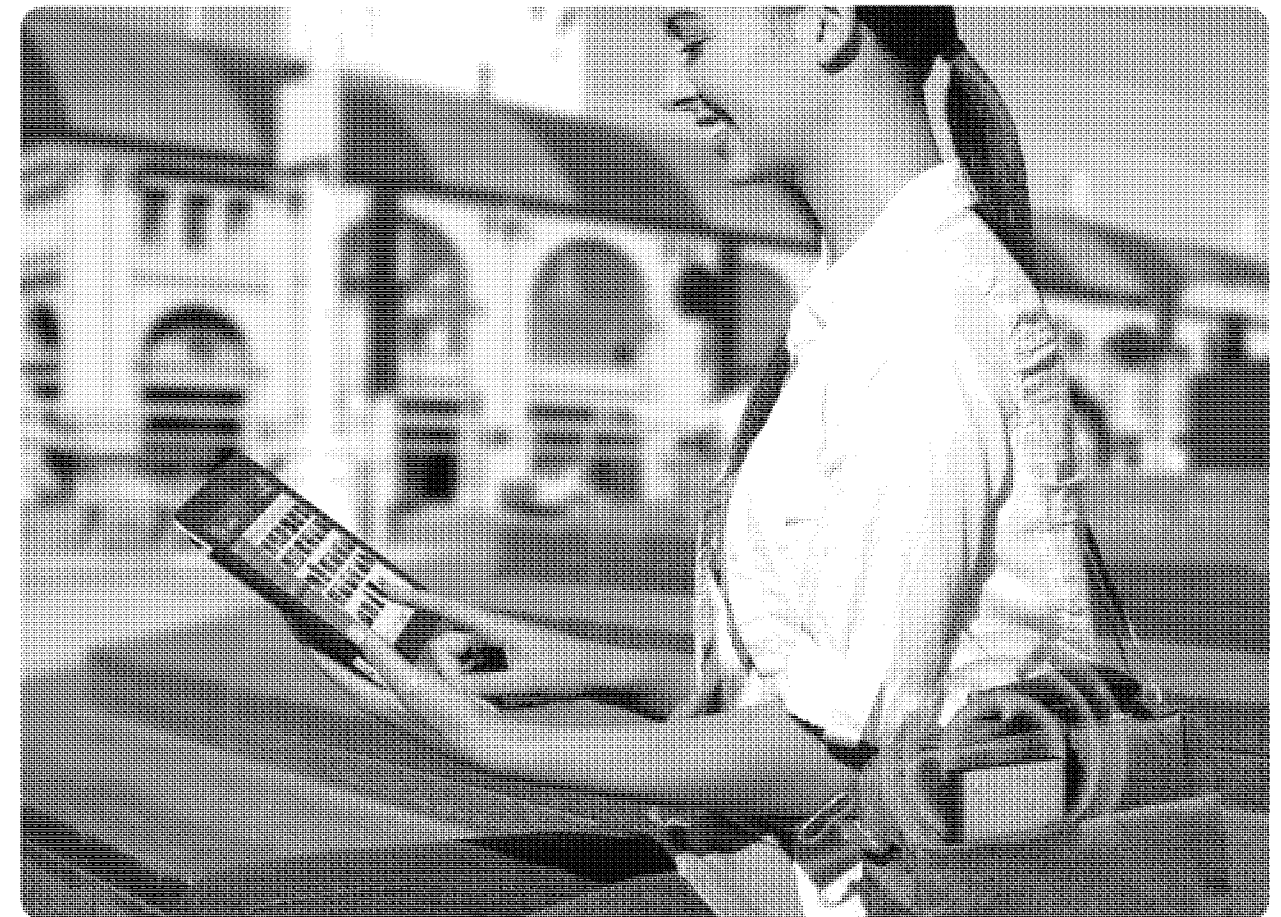
- Automatically back up multiple PC and Mac computers
- Wirelessly stream your centralized media library to gaming consoles, media players and smart TVs
- Access content on-the-go with a Web browser or the free app for tablets and smartphones

### Best-Fit Applications

- Consolidate content on one easily accessible device
- Back up multiple PC and Mac computers
- Enjoy a centralized media library on smart TVs, game consoles and media players
- Access your content on-the-go with laptops and mobile devices
- Archive your Facebook photos and videos



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STCG4000100	SATA/GigE	● Black	PC, Mac
3TB	STCG3000100	SATA/GigE	● Black	PC, Mac
2TB	STCG2000100	SATA/GigE	● Black	PC, Mac
PRODUCT DIMENSIONS	5.7-in L x 8.5-in W x 1.7-in D (145mm x 216mm x 42mm)			
PACKAGE DIMENSIONS	3.15-in L x 10.3-in W x 9.25-in D (80mm x 261mm x 235mm)			





# Business Storage 4-Bay NAS


A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations

### Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0, 1, 5 and 10 configuration options

### Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage
- Encrypt individual files to entire volumes of data
- Transport large files using external drives

				
CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
16TB	STBP16000100	Gigabit Ethernet	● Black	PC, Mac
12TB	STBP12000100	Gigabit Ethernet	● Black	PC, Mac
8TB	STBP8000100	Gigabit Ethernet	● Black	PC, Mac
4TB	STBP4000100	Gigabit Ethernet	● Black	PC, Mac
—	STBP100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	6.3-in W x 8.2-in H x 10.2-in D (161.00mm x 208.00mm x 258.50mm)			
PACKAGE DIMENSIONS	9.4-in W x 14.9-in H x 9.4-in D (240.00mm x 379.00mm x 243.00mm)			

# Business Storage 2-Bay NAS


Create a private cloud to help protect your business-critical data and centralize files in a single location you can access from anywhere

### Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0 and 1 configuration options

### Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage

				
CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
8TB	STBN8000100	Gigabit Ethernet	● Black	PC, Mac
6TB	STBN6000100	Gigabit Ethernet	● Black	PC, Mac
4TB	STBN4000100	Gigabit Ethernet	● Black	PC, Mac
—	STBN100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	4.1-in W x 8.0-in H x 8.9-in D (104.50mm x 204.00mm x 227.00mm)			
PACKAGE DIMENSIONS	6.2-in W x 10.9-in H x 12.5-in D (157.00mm x 277.00mm x 317.00mm)			

# Business Storage 1-Bay NAS

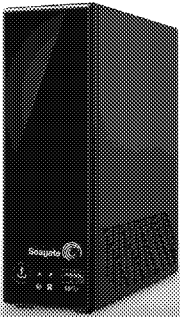
Create a private cloud with Seagate Business Storage 1-Bay NAS. It helps protect your all-important data and centralizes your files in a single location you can access from anywhere.

### Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Stream your media library to networked computers, Internet TVs, game consoles and more

### Best-Fit Applications

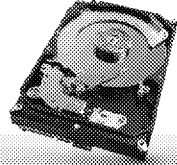
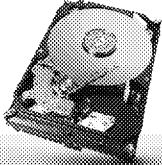

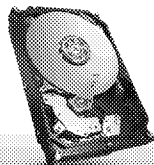

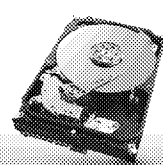
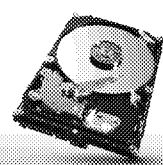
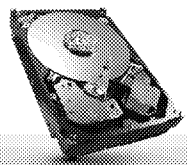
- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage


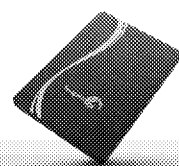
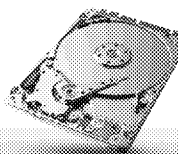

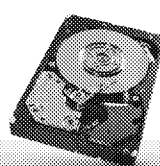
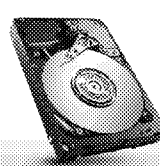
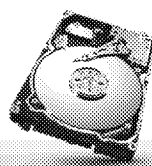



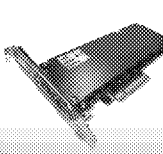

				
CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STBM4000100	Gigabit Ethernet	● Black	PC, Mac
3TB	STBM3000100	Gigabit Ethernet	● Black	PC, Mac
2TB	STBM2000100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	2.4-in W x 6.9-in H x 5.8-in D (61mm x 176mm x 148mm)			
PACKAGE DIMENSIONS	3.7-in W x 9.3-in H x 9.0-in D (93mm x 236mm x 229mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to hard drive capacity.  
<sup>2</sup> U.S. model numbers shown

# Internal Storage

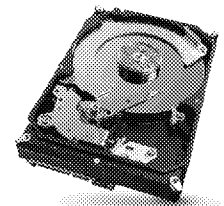
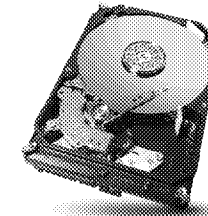
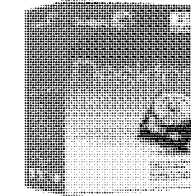
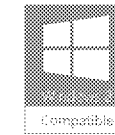
## At-a-Glance Product Comparison

	DESKTOP				ENTERPRISE		VIDEO STORAGE	
3.5-inch								
	Desktop SSHD	Desktop HDD	Cheetah® 15K	NAS HDD	Enterprise Capacity 3.5 HDD	Terascale™ HDD	SV35 Series™	Video 3.5 HDD
BUSINESS NEED	Performance	Mainstream	Performance	Performance	Mainstream	Low Power	Surveillance	DVR
USE THIS DRIVE FOR	Desktop solutions requiring SSD-like performance and massive capacities at an affordable price	Desktop compute where choice in capacity and cache options to provide design flexibility is important	High-capacity, compute-intensive requirements demanding high performance and availability	Small NAS systems needing performance with high capacities	Bulk-data applications requiring reliable, highest-capacity storage, efficiency and enterprise-class reliability	Cost-effective, low-power bulk storage solutions for unstructured data in clouds	Surveillance systems that require high performance, low-power and centralized storage for every surveillance application	DVR systems where reliable, low-power, purpose-built storage is required for video streaming applications
ENCRYPTION MODELS AVAILABLE			X		X			
LEARN MORE	Page 18	Page 18	Page 30	Page 32	Page 31	Page 30	Page 39	Page 38

	LAPTOP				ENTERPRISE HDD			ENTERPRISE SSD			VIDEO STORAGE	
2.5-inch												
	Laptop SSHD and Laptop Thin SSHD	600 SSD	Laptop Ultrathin HDD	Momentus® Thin	Enterprise Performance 15K HDD	Enterprise Performance 10K HDD	Constellation®	600 Pro SSD	1200 SSD	Pulsar.2™	X8 Accelerator	Video 2.5 HDD
BUSINESS NEED	Performance	Extreme Performance	Ultrathin (5mm z-ht.)	Thin (7mm z-ht.)	Performance	Mainstream	Low Power	Performance, Low Power	Performance	Mainstream	Low-Profile PCIe	DVR
USE THIS DRIVE FOR	The ultimate mobile computing experience, with SSD-like performance for all applications and OS environments	On-the-go users who need the fastest performance and improved ruggedness	Slim laptops and devices that need light, affordable, high-capacity storage	Slim computing devices such as thin laptops and netbooks, where z-height makes all the difference	Compute-intensive data requirements demanding the highest performance density and availability	Mainstream data requiring high capacity, performance density and reliability	Online reference data demands requiring cost-effective, low-power, enterprise-class drives	Data center and cloud applications that require fast performance and low power	Enterprise storage environments requiring high-capacity SSD with data integrity and drive endurance	Enterprise environments requiring MLC-enabled, high-capacity SSD with data integrity and drive endurance	Ideal for database, virtualization and hyper-scale applications	Video streaming where 24x7 operation, small form factor and low power consumption are needed
ENCRYPTION MODELS AVAILABLE			X	X	X	X	X		X	X		
LEARN MORE	Page 22	Page 23	Page 23	Page 24	Page 28	Page 29	Page 32	Page 34	Page 34	Page 35	Page 35	Page 38

# Desktop Storage Solutions

Seagate has a distinguished history in consistently delivering innovative technologies, super-sized capacities, low power and blazing-fast performance. Seagate desktop drives offer excellent performance at all levels.



		DESKTOP 3.5-INCH INTERNAL KIT	DESKTOP HDD	DESKTOP SSHD
Product Comparison	Application	Mainstream	Mainstream and Performance	Performance
	Description	The fast, powerful and easy way to upgrade or add storage capacity to desktop computers	Tuned performance for low-power, mainstream and high-performance desktop computing	Solid state hybrid drive delivers SSD-like performance without sacrificing capacity
	Form Factor	3.5 inch	3.5 inch	3.5 inch
	Reliability (AFR)	<1%	<1%	<1%
	Max. Ext. Transfer Rate	300MB/s to 600MB/s	600MB/s	150MB/s to 600MB/s
	Capacity <sup>1</sup>	500GB to 3TB	250GB to 4TB	1TB and 2TB
	Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s
	Cache	16MB to 64MB	16MB to 64MB	64MB
	Power (Idle)		4.0W to 5.8W	<3.3 to <3.9
Feature Comparison	Product	Desktop 3.5-inch Internal Kit	Desktop HDD	Desktop SSHD
	SATA Interface	X	X	X
	Sustainable Technology	X	X	X
	Best-in-Class Performance	X	X	X
	Capacity Leadership	X	X	X
	Quiet Acoustics	X	X	X
	DiscWizard™ Installation Software	X	X	X
	Compatible with Windows 8 <sup>2</sup>	X	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 8, visit <http://www.seagate.com/en-us/windows/compatibility/windows/compatcenter/home>



# Desktop SSHD

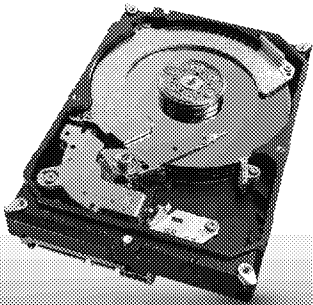
Seagate Desktop SSHD (solid state hybrid drive) delivers SSD-like performance and massive capacities at an affordable price.

## Key Advantages

- First SSHD in a 3.5-inch form factor
- SATA 6Gb/s with NCQ for interface speed
- Up to 3x faster than a traditional HDD<sup>2</sup>
- All-in-one design for ease of installation
- Installs and operates like a standard hard drive
- Massive 1TB or 2TB capacities combined with SSD-like performance<sup>2</sup>

## Best-Fit Applications

- Desktop PCs
- Workstations
- High-performance direct-attached storage (DAS) devices



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
2TB	ST2000DX001	SATA 6Gb/s	64MB
1TB	ST1000DX001	SATA 6Gb/s	64MB

# Desktop 3.5-Inch Internal Kit

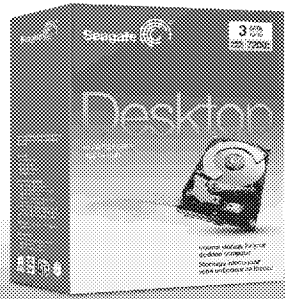
Seagate 3.5-inch internal drives are the fast, powerful, and easy way to upgrade or add storage capacity to desktop computers.

## Key Advantages

- Quiet, ultra-high performance
- DiscWizard™ software makes installation a snap
- Built-in self-monitoring technology helps ensure maximum reliability

## Best-Fit Applications

- Gaming PCs
- Workstations
- High-end PCs
- Desktop RAID
- Mainstream/office PCs



CAPACITY <sup>1</sup>	KIT NUMBER <sup>3</sup>	INTERFACE	CACHE
4TB	STBD4000400	SATA 6Gb/s	64MB
3TB	STBD3000100	SATA 6Gb/s	64MB
2TB	STBD2000101	SATA 6Gb/s	64MB
1TB	ST310005N1A1AS-RK	SATA 6Gb/s	64MB
500GB	ST3500641AS-RK	SATA 3Gb/s	64MB
PACKAGE DIMENSIONS	7.38-in L x 5.88-in W x 2.88-in D (187mm x 149mm x 73mm)		

# Desktop HDD

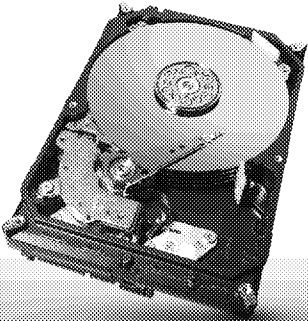
Seagate Desktop HDDs give you the Power of One with 1TB-per-disk technology and one drive platform for every capacity and application.

## Key Advantages

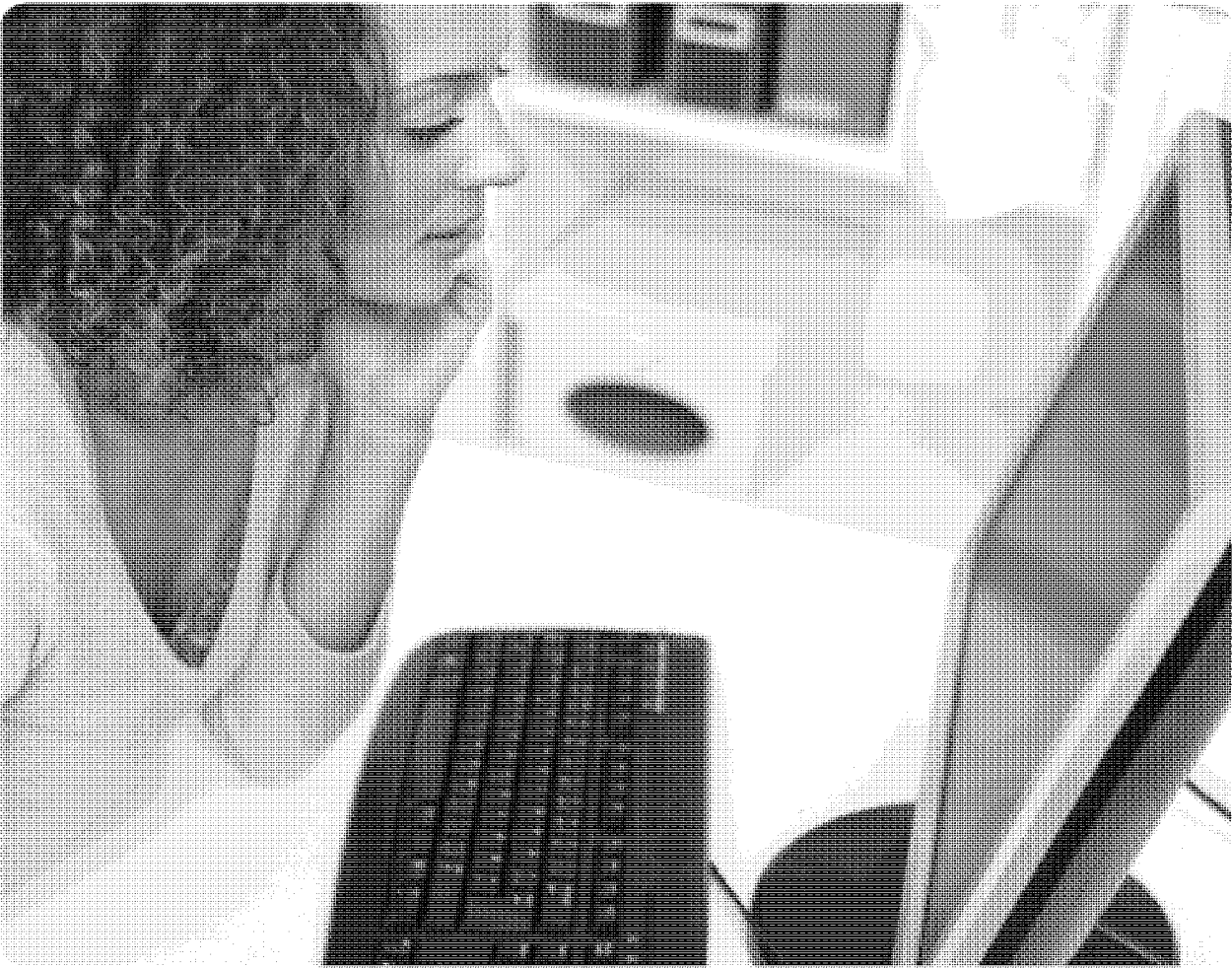
- Up to 4TB capacity
- AcuTrac™ and OptiCache™ technologies deliver dependable overall performance.
- Free Seagate DiscWizard™ software

## Best-Fit Applications

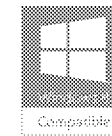
- Desktop or all-in-one PCs and home servers
- PC-based gaming systems
- Direct-attached external storage devices (DAS)



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000DM000	SATA 6Gb/s NCQ	64MB
3TB	ST3000DM001	SATA 6Gb/s NCQ	64MB
2TB	ST2000DM001	SATA 6Gb/s NCQ	64MB
1TB	ST1000DM003	SATA 6Gb/s NCQ	64MB
500GB	ST500DM002	SATA 6Gb/s NCQ	16MB
320GB	ST320DM000	SATA 6Gb/s NCQ	16MB
250GB	ST250DM000	SATA 6Gb/s NCQ	16MB

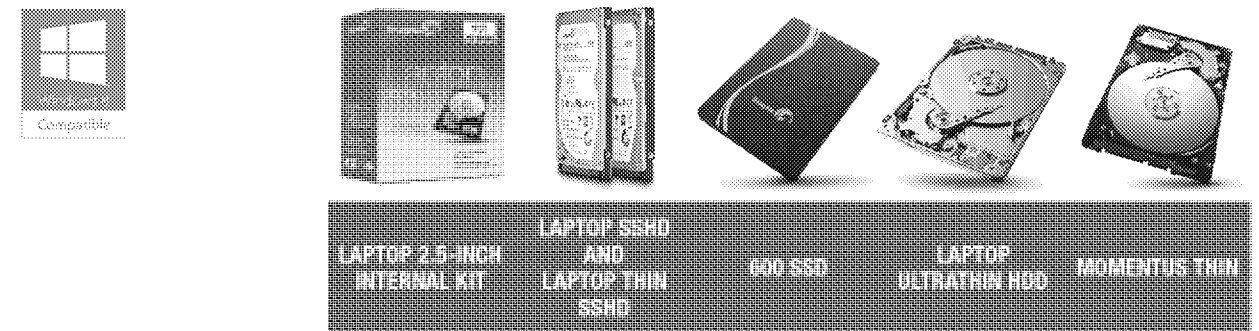


<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Performance may vary depending on user's hardware configuration and operating system.  
<sup>3</sup> U.S. model numbers shown.



# Laptop Storage Solutions

Seagate laptop drives address every mobile market need, delivering superior performance, reliability and value. Feature-rich with innovative options, the Seagate laptop lineup also includes self-encryption and FIPS 140-2 validated models.



Product Comparison	Application	Mainstream and Performance	Performance	Extreme Performance	Slim Computing	Slim Computing
	Description	A complete upgrade kit to transform your system to high performance or just add capacity	Solid state hybrid drives deliver SSD-like performance without sacrificing capacity	Speed up your laptop with SSD performance and ruggedness	Affordable, high-capacity storage that is thinner than a pencil	The world's thinnest 2.5-inch drive for slim laptops and netbooks
	Form Factor	2.5 inch	2.5 inch	5mm/7mm, 2.5 inch	5mm, 2.5 inch	7mm, 2.5 inch
	Reliability (AFR)	0.40% to 0.50%	0.48%	0.58%		0.48%
	Capacity <sup>1</sup>	250GB to 1TB	500GB and 1TB	120GB to 480GB	320GB and 500GB	250GB to 500GB
	Interface	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s
	Cache	8MB to 32MB	64MB		16MB	16MB
	Power (Idle)		0.8W to 1.1W	1.1W	0.48W	0.45W to 0.66W
	Product	Laptop 2.5-inch Internal Kit	Laptop SSHD and Laptop Thin SSHD	600 SSD	Laptop Ultrathin HDD	Momentus Thin
Feature Comparison	SATA Interface	X	X	X	X	X
	Lowest Acoustics					X
	Lowest Power					X
	Self-Encrypting Drive				X	X
	Drop Sensor Options				X	
	Solid State Hybrid	X	X			
	Compatible with Windows 8 <sup>2</sup>	X		X	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 8, visit <http://www.microsoft.com/en-us/windows/compatibility/win8/CompatCenter/Home>



# Laptop SSHD and Laptop Thin SSHD

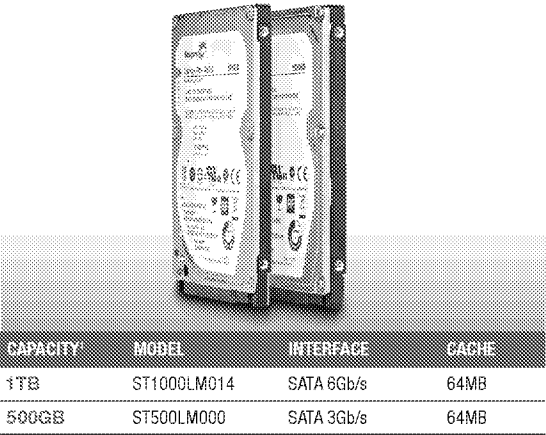
The Seagate Laptop SSHD (1TB) and Laptop Thin SSHD (500GB) enable laptop PC users to enjoy solid state performance without sacrificing capacity.

## Key Advantages

- Boots and performs like an SSD<sup>2</sup>
- Up to 4x faster than a traditional HDD<sup>2</sup>
- SATA 6Gb/s with NCQ for interface speed
- All-in-one design for simplicity and ease of installation
- Works in any laptop or PC, any OS and any application
- Backed by a 3-year limited warranty

## Best-Fit Applications

- Laptops and mobile workstations
- Desktop and tower workstations
- High-performance laptop and desktop gaming systems
- Small form factor all-in-one PCs



CAPACITY	MODEL	INTERFACE	CACHE
1TB	ST1000LM014	SATA 6Gb/s	64MB
500GB	ST500LM000	SATA 3Gb/s	64MB

# 600 SSD

The ultimate performance upgrade for existing laptops, the Seagate 600 SSD is a fast, rugged, 2.5-inch, SATA 6Gb/s solid state drive.

## Key Advantages

- Nearly 4x faster boot times and over 2x faster application load times than typical laptop HDDs
- Significantly reduces the amount of time end users must wait before using their devices
- Allows end users to access data faster and to take advantage of superior laptop responsiveness
- The ultimate upgrade drive for road warriors, power users, executives and gamers—work and play faster

## Best-Fit Applications

- Performance upgrade for existing laptops with 2.5-inch hard drives
- Improved ruggedness upgrade for existing laptops that may be dropped while operating
- Data center caching



CAPACITY	7MM 2.5-HT MODEL	INTERFACE	FLASH TYPE
480GB	ST480HM000	SATA 6Gb/s	MLC
240GB	ST240HM000	SATA 6Gb/s	MLC
120GB	ST120HM000	SATA 6Gb/s	MLC

CAPACITY	5MM 2.5-HT MODEL	INTERFACE	FLASH TYPE
480GB	ST480HM001	SATA 6Gb/s	MLC
240GB	ST240HM001	SATA 6Gb/s	MLC
120GB	ST120HM001	SATA 6Gb/s	MLC

# Laptop Ultrathin HDD

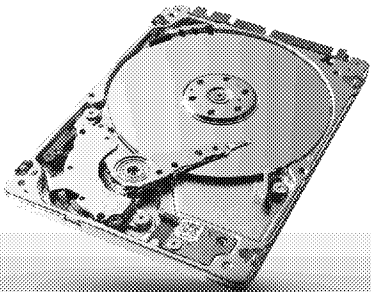
The Seagate Laptop Ultrathin HDD is one of the thinnest and lightest laptop hard drives—5mm, 3.3 oz. and thinner than a pencil.

## Key Advantages

- Affordable, high-capacity storage gives system builder options when integrating low profile storage into slim laptop and ultrabook solutions
- Compatible with every portable PC with a standard SATA 6Gb/s interface
- Get industry-leading cost-per-GB and cost-per-millimeter
- Seagate Secure™ Self-Encrypting Drive options<sup>3</sup>

## Best-Fit Applications

- Slim laptops or ultrabooks
- Extending high-capacity, affordable storage into other applications and slim devices
- Backup storage



CAPACITY	MODEL	INTERFACE	CACHE
500GB	ST500LT032	SATA 6Gb/s	16MB
500GB	ST500LT033 <sup>3</sup>	SATA 6Gb/s	16MB
320GB	ST320LT030	SATA 6Gb/s	16MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Performance may vary depending on user's hardware configuration and operating system. Testing performed on a Laptop SSHD 1TB and a Laptop Thin SSHD 500GB.  
<sup>3</sup> Self-Encrypting Drives (SED) are not available in all models or countries. May require TCG-compliant host or controller support.

# Momentus® Thin

The 7mm, 2.5-inch drive enables slim computing for all types of mobile computing, from laptops to netbooks to smaller desktop PCs.

## Key Advantages

- 7mm z-height form factor enables thin chassis design for all segments of laptop computing.
- Seagate SmartAlign™ technology provides a transition to 4K sectors without the need for software utilities.
- Self-Encrypting Drive options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification<sup>3</sup> are government-approved for the U.S. and Canadian governments.

## Best-Fit Applications

- Thin entry-level laptop PCs
- Thin high-end netbooks
- Thin ultraportables



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
500GB	ST500LT025 <sup>2,4</sup>	SATA 6Gb/s	16MB
500GB	ST500LT015 <sup>2,4</sup>	SATA 6Gb/s	16MB
500GB	ST500LT012	SATA 6Gb/s	16MB
320GB	ST320LT012 <sup>4</sup>	SATA 6Gb/s	16MB
250GB	ST250LT012 <sup>4</sup>	SATA 6Gb/s	16MB

# Laptop 2.5-Inch Internal Kit

Seagate 2.5-inch internal drives deliver vast amounts of storage for adding capacity or upgrading drives in laptop computers.

## Key Advantages

- Built for mobility
- Preserves battery life
- Large data cache
- Outstanding performance
- Laptop solid state hybrid model offers SSD-like performance with the capacity of a hard drive.

## Best-Fit Applications

- Replacement laptop drives
- Laptop storage upgrades
- High-end laptops and workstations



CAPACITY <sup>1</sup>	KIT NUMBER <sup>5</sup>	INTERFACE	CACHE
1TB	STBD1000100	SATA 3Gb/s	8MB
500GB	ST905003N3A1AS-RK	SATA 3Gb/s	16MB
500GB	ST905003N1A1AS-RK	SATA 3Gb/s	8MB
250GB	ST90250N1A1AS-RK	SATA 3Gb/s	8MB
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		

LAPTOP SSD MODEL			
CAPACITY <sup>1</sup>	KIT NUMBER <sup>5</sup>	INTERFACE	MLC FLASH
1TB	STBD1000400	SATA 6Gb/s	8GB
500GB	STBD750100	SATA 6Gb/s	8GB
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/usvp/documents/140-1/1401vnd.htm>  
<sup>4</sup> SmartAlign technology is not available on 8B's model.  
<sup>5</sup> U.S. model numbers shown.

# Enterprise Storage Solutions

With more than 30 years of experience and the broadest storage product portfolio available, Seagate consistently designs, builds and supports industry-leading enterprise hard drives, solid state drives and hybrid drives. Seagate has the global presence, processes and resources to support businesses of all sizes with the highest-quality enterprise storage products.



HDD Product Comparison

	ENTERPRISE PERFORMANCE HDD	CHEETAH <sup>®</sup>	ENTERPRISE CAPACITY HDD	NAS HDD
Application	SFF Performance and Mainstream	LFF Performance	High Capacity and Low Power	Small NAS
Description	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 2.5-inch form factor	High performance, legacy 15K-RPM enterprise hard drive in a 3.5-inch form factor	High-capacity, lowest-power, reliable 7200-RPM enterprise hard drive in both 2.5- and 3.5-inch form factors	Best-performing, highest-capacity storage for 1- to 5-bay NAS systems
Form Factor	2.5-inch	3.5-inch	2.5-inch and 3.5-inch	3.5-inch
Reliability (AFR)	0.44%	0.55%	0.62% and 1.095%	
Capacity <sup>1</sup>	300GB to 900GB	300GB to 600GB	250GB to 4TB	2TB to 4TB
Power (Idle)	3.0W to 4.4W	8.74W to 11.68W	2.52W to 7.7W	3.0W to 3.95W
Interface	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, SATA 6Gb/s	SATA 6Gb/s
Limited Warranty <sup>4</sup>	5 years	5 years	3 years and 5 years	3 years

HDD Feature Comparison

Product	Enterprise Performance (2.5-inch)	Enterprise Performance (3.5-inch)	Cheetah LFF	Cheetah LFF	Enterprise Capacity (2.5-inch)	Enterprise Capacity (3.5-inch)	NAS HDD
Best-in-Class Performance	X	X	X	X	X		X
Capacity Leadership	X	X	X	X	X	X	
Vibration Tolerance for Multi-Drive Stabilization	X	X	X	X	X	X	X
6Gb/s SAS Interface	X	X	X	X	X		
4Gb/s FC Interface		X	X				
6Gb/s SATA Interface				X	X	X	X
Best-in-Class Power Usage		X		X	X	X	X
PowerChoice™ Optimized Idle Power Settings	X	X		X	X	X	
Self-Encrypting Drive (SED) <sup>2</sup>	X	X	X	X	X		
FIPS 140-2 SED <sup>3,4</sup>	X	X	X	X	X		

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Encrypting Drive models may require TCG compliant host or controller support.

<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cmvp/documents/140-1/1401vend.htm>.

<sup>4</sup> Warranty terms may vary based on usage. Consult your Seagate sales representative for warranty terms and conditions.



## Enterprise Performance 15K HDD

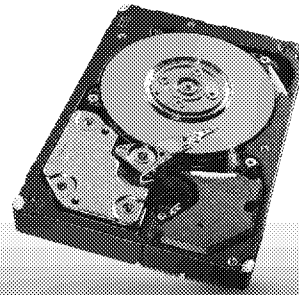
Seagate Enterprise Performance 15K HDDs leverage a 2.5-inch form factor to deliver pronounced performance advantages and power savings over legacy 3.5-inch drives.

### Key Advantages

- Stores 2x the Tier 1 data over previous generation without increasing drive count
- Enables Tier 1 applications to process transactions more quickly
- Best-in-class idle power for more efficient storage operations
- Industry's highest MTBF at 2M hours
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS SED<sup>4</sup> options cut IT drive retirement costs and help protect data.

### Best-Fit Applications

- High-performance Tier 1 enterprise servers
- Blade, rack and tower servers hosting transaction-based applications
- Power- and space-constrained data centers
- Compliance and data security initiatives



CAPACITY <sup>1</sup>	5K <sup>2</sup> NATIVE MODEL	INTERFACE	CACHE
450GB	ST450MP0004	6Gb/s SAS	128MB
450GB	ST450MP0014 <sup>2</sup>	6Gb/s SAS	128MB
300GB	ST300MP0004	6Gb/s SAS	128MB
300GB	ST300MP0014 <sup>2</sup>	6Gb/s SAS	128MB

CAPACITY <sup>1</sup>	5K <sup>2</sup> EMULATION MODEL	INTERFACE	CACHE
600GB	ST600MP0034	6Gb/s SAS	128MB
600GB	ST600MP0044 <sup>2</sup>	6Gb/s SAS	128MB
600GB	ST600MP0054 <sup>2,4</sup>	6Gb/s SAS	128MB
450GB	ST450MP0034	6Gb/s SAS	128MB
450GB	ST450MP0044 <sup>2</sup>	6Gb/s SAS	128MB
300GB	ST300MP0034	6Gb/s SAS	128MB
300GB	ST300MP0044 <sup>2</sup>	6Gb/s SAS	128MB

CAPACITY <sup>1</sup>	4K <sup>2</sup> NATIVE MODEL	INTERFACE	CACHE
600GB	ST600MP0064	6Gb/s SAS	128MB
600GB	ST600MP0074 <sup>2</sup>	6Gb/s SAS	128MB
600GB	ST600MP0084 <sup>2,4</sup>	6Gb/s SAS	128MB
450GB	ST450MP0064	6Gb/s SAS	128MB
450GB	ST450MP0074 <sup>2</sup>	6Gb/s SAS	128MB
300GB	ST300MP0064	6Gb/s SAS	128MB
300GB	ST300MP0074 <sup>2</sup>	6Gb/s SAS	128MB

## Enterprise Performance 10K HDD

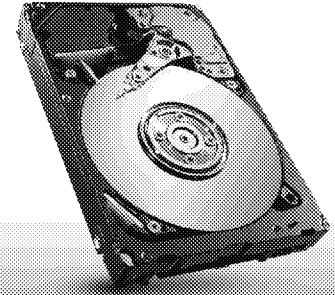
Seagate Enterprise Performance 10K HDDs deliver the optimal balance of capacity, performance and power in a 10K-RPM, 2.5-inch enterprise drive.

### Key Advantages

- Highest-capacity enterprise SFF hard drive (up to 1.2TB)
- PowerChoice™ technology reduces power consumption.
- Protection Information (PI) detects corruption of data in flight between the host system and the drive<sup>5</sup>
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Mission-critical servers and external storage arrays
- Power- and space-constrained data centers
- Compliance or data security initiatives



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
1200GB	ST1200MM0017 <sup>2</sup>	6Gb/s SAS	64MB
1200GB	ST1200MM0027 <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST900MM0026 <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST900MM0036 <sup>2,4</sup>	6Gb/s SAS	64MB
900GB	ST9900805SS	6Gb/s SAS	64MB
900GB	ST9900705SS <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST9900605SS <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST9900805FC	4Gb/s FC	64MB
600GB	ST600MM0026 <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600205SS	6Gb/s SAS	64MB
600GB	ST9600105SS <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600005SS <sup>2,3</sup>	6Gb/s SAS	64MB
600GB	ST9600205FC	4Gb/s FC	64MB
450GB	ST450MM0026 <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450405SS	6Gb/s SAS	64MB
450GB	ST9450305SS <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450205SS <sup>2,3</sup>	6Gb/s SAS	64MB
450GB	ST9450405FC	4Gb/s FC	64MB
300GB	ST300MM0026 <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300605SS	6Gb/s SAS	64MB
300GB	ST9300505SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300405SS <sup>2,3</sup>	6Gb/s SAS	64MB
300GB	ST9300605FC	4Gb/s FC	64MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cmvp/documents/140-1/1401rand.htm>.  
<sup>4</sup> FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cmvp/validation.htm#05>.  
<sup>5</sup> Protection Information (PI) feature requires PI-compliant host or controller support.

## Cheetah® 15K

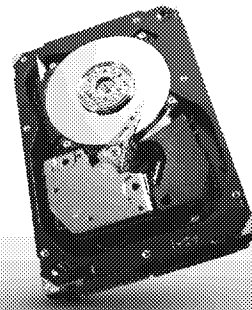
The Seagate Cheetah 15K drive provides high performance and reliability in legacy 3.5-inch mission-critical storage.

### Key Advantages

- Sustained data rate of up to 204MB/s
- Industry's highest 3.5-inch drive reliability
- Powertrim™ technology optimizes power consumption
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Business and transaction processing
- Email and decision support
- Storage Area Networks (SAN)
- Network Attached Storage (NAS)
- Internet and e-commerce



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
600GB	ST3600057SS	6Gb/s SAS	16MB
600GB	ST3600957SS <sup>2</sup>	6Gb/s SAS	16MB
600GB	ST3600857SS <sup>2,3</sup>	6Gb/s SAS	16MB
600GB	ST3600957FC	4Gb/s FC	16MB
450GB	ST3450857SS	6Gb/s SAS	16MB
450GB	ST3450757SS <sup>2</sup>	6Gb/s SAS	16MB
450GB	ST3450657SS <sup>2,3</sup>	6Gb/s SAS	16MB
450GB	ST3450857FC	4Gb/s FC	16MB
300GB	ST3300657SS	6Gb/s SAS	16MB
300GB	ST3300557SS <sup>2</sup>	6Gb/s SAS	16MB
300GB	ST3300457SS <sup>2,3</sup>	6Gb/s SAS	16MB
300GB	ST3300657FC	4Gb/s FC	16MB

## Terascale™ HDD

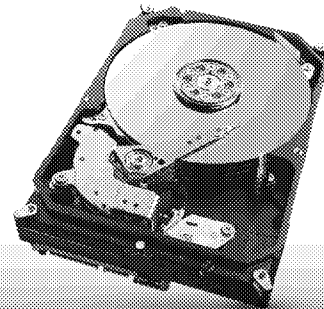
The Seagate Terascale HDD is designed for large-scale data centers where low-cost, low-power and high-capacity storage is critical.

### Key Advantages

- Affordable storage for 24x7 multi-drive replicated environments
- High vibration tolerance for reliable enterprise-class performance
- Low power and cooling costs with the lowest 3.5-inch enterprise drive operating power
- Advanced format logical block management for industry-leading data integrity

### Best-Fit Applications

- Web-scale computing
- Cloud storage servers and arrays
- Cloud backup storage
- Direct-attached external storage (DAS)
- Network-attached storage (NAS)



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000NC000 <sup>4</sup>	SATA 6Gb/s	64MB
4TB	ST4000NC001	SATA 6Gb/s	64MB

## Enterprise Capacity 3.5 HDD

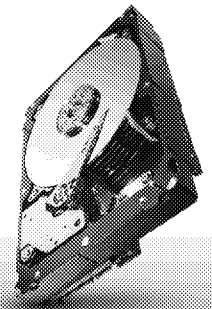
The Seagate Enterprise Capacity 3.5 HDDs help data centers meet the demanding growth of unstructured data.

### Key Advantages

- Highest-capacity enterprise drive for maximum density server and storage solutions
- SAS and SATA interfaces with 24x7 reliability
- Predictable 7200-RPM performance even in the most rugged multi-drive environments
- Improved power and cooling efficiencies with low power consumption and on-demand PowerChoice™ technology
- Protect your data and ease data disposal costs and management with the Self-Encrypting Drive (SED) and FIPS 140-2 certified SED options<sup>2,3</sup>

### Best-Fit Applications

- High-capacity RAID storage
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000NM0033	SATA 6Gb/s	128MB
4TB	ST4000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
4TB	ST4000NM0073 <sup>2,3</sup>	SATA 6Gb/s	128MB
4TB	ST4000NM0023	6Gb/s SAS	128MB
4TB	ST4000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
4TB	ST4000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB
3TB	ST3000NM0033	SATA 6Gb/s	128MB
3TB	ST3000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
3TB	ST3000NM0023	6Gb/s SAS	128MB
3TB	ST3000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
3TB	ST3000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB
2TB	ST2000NM0033	SATA 6Gb/s	128MB
2TB	ST2000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
2TB	ST2000NM0023	6Gb/s SAS	128MB
2TB	ST2000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
2TB	ST2000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB
1TB	ST1000NM0033	SATA 6Gb/s	128MB
1TB	ST1000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
1TB	ST1000NM0023	6Gb/s SAS	128MB
1TB	ST1000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
1TB	ST1000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Encrypting Drive (SED) and FIPS 140-2 Validated drives are not available in all models or countries.

May require TOG-compliant host or controller support.

<sup>3</sup> FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/comp/documents/140-1/1401-vol2011.html#1835>

<sup>4</sup> Seagate Instant Secure Drive Model



## Constellation®

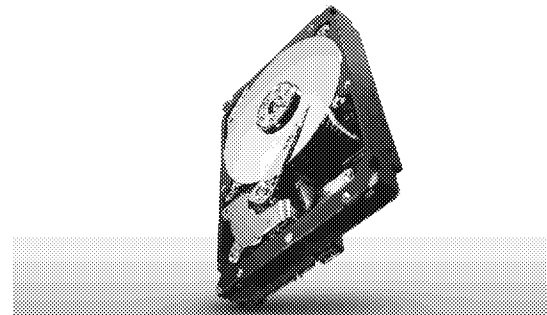
The Seagate Constellation drive is the only 2.5-inch enterprise-class hard drive delivering both 1TB capacities and enterprise reliability.

### Key Advantages

- Maximizes data center footprint
- Energy-efficient storage at under 3.9W (idle)
- Highest nearline reliability with an MTBF of 1.4M hours
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data.
- FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Storage-hungry business applications
- Storage area networks and network attached storage
- Maximum-capacity servers and blade servers
- Rich media content storage
- Enterprise backup and restore—D2D, virtual tape
- Cloud computing



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
1TB	ST91000640NS	SATA 6Gb/s	64MB
1TB	ST91000641NS <sup>2</sup>	SATA 6Gb/s	64MB
1TB	ST91000642NS <sup>2,3</sup>	SATA 6Gb/s	64MB
1TB	ST91000640SS	6Gb/s SAS	64MB
1TB	ST91000641SS <sup>2</sup>	6Gb/s SAS	64MB
1TB	ST91000642SS <sup>2,3</sup>	6Gb/s SAS	64MB
500GB	ST9500620NS	SATA 6Gb/s	64MB
500GB	ST9500621NS <sup>2</sup>	SATA 6Gb/s	64MB
500GB	ST9500622NS <sup>2,3</sup>	SATA 6Gb/s	64MB
500GB	ST9500620SS	6Gb/s SAS	64MB
500GB	ST9500621SS <sup>2</sup>	6Gb/s SAS	64MB
500GB	ST9500622SS <sup>2,3</sup>	6Gb/s SAS	64MB
250GB	ST9250610NS	SATA 6Gb/s	64MB
250GB	ST9250611NS <sup>2</sup>	SATA 6Gb/s	64MB
250GB	ST9250612NS <sup>2,3</sup>	SATA 6Gb/s	64MB

## NAS HDD

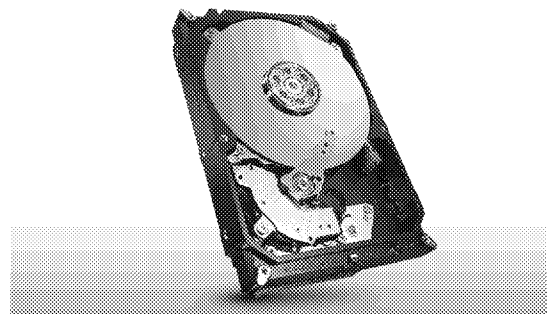
The Seagate NAS HDD fine-tunes the needs of 1- to 5-bay NAS systems to provide industry-leading performance and highest-capacity storage.

### Key Advantages

- NASWorks™ technology supports custom error recovery controls, power management and vibration tolerance.
- NAS error recovery controls help to ensure drives are not dropped from the NAS and sent into a RAID rebuild.
- Improved vibration tolerance and emission in multi-drive systems with dual-plane balance
- Advanced power management supports multiple power profiles for low-power, 24x7 performance.

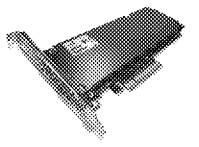
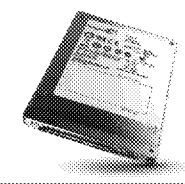
### Best-Fit Applications

- Home servers or desktop NAS solutions
- Small-business file sharing
- Backup servers



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000VN000	SATA 6Gb/s	64MB
3TB	ST3000VN000	SATA 6Gb/s	64MB
2TB	ST2000VN000	SATA 6Gb/s	64MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cwp/documents/140-1/1401vnd.htm>.



	600 PRO SSD	1200 SSD	PULSAR®	X8 ACCELERATOR
Application	Low Power, Performance SSD	High-Performance SSD	Mainstream SSD	Low-Profile PCIe
Description	Fast performance and low power for performance-hungry data center and cloud applications	Ultra-fast, consistent performance for demanding enterprise storage and server applications	Performance, data integrity and drive endurance in an enterprise solid state drive	Memory-class performance and storage-class capacity in a low-profile PCIe card
Form Factor	2.5-inch	2.5-inch	2.5-inch	1/2-length × 1/2-height card
Reliability (AFR)	0.58%	0.44%	0.44%	0.58%
Capacity <sup>1</sup>	100GB to 480GB	200GB to 800GB	100GB to 800GB	461GB to 2222GB
NAND Flash Type	MLC	MLC	MLC	MLC
Power (Idle)	1.05W to 1.25W	2.72W to 3.0W	3.47W to 4.38W	8W to 15W
Interface	SATA 6Gb/s	12Gb/s SAS	6Gb/s SAS, SATA 6Gb/s	8-Lane PCIe 2.0
Limited Warranty <sup>4</sup>	5 years	5 years	5 years	5 years
Product	600 Pro SSD	1200 SSD	Pulsar 2	X8 Accelerator
12Gb/s SAS Interface		X		
6Gb/s SAS Interface			X	
SATA 6Gb/s Interface	X		X	
8-Lane PCIe 2.0 Interface				X
Self-Encrypting Drive (SED) <sup>2</sup>		X	X	
FIPS 140-2 SED <sup>2,3</sup>		X	X	

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cwp/documents/140-1/1401vnd.htm>  
<sup>4</sup> Warranty terms may vary based on usage. Consult your Seagate sales representative for warranty terms and conditions.

## 600 Pro SSD

A class above client SSDs, Seagate 600 Pro SSDs deliver a best-in-class combination of fast, consistent performance and low power.

### Key Advantages

- Delivers the highest IOPS/watt to improve system performance and reduce power and cooling costs for data center and cloud applications
- Fast, consistent performance and low latency over the warranty period of the drive
- Helps reduce performance gaps between storage I/O and CPU operations

### Best-Fit Applications

- Data center applications (fast data indexing, edge caching)
- Data streaming
- Content delivery networks
- Gaming and software delivery
- Virtualization and other cloud applications



CAPACITY <sup>1</sup>	MODEL	INTERFACE	NAND FLASH TYPE
480GB	ST480FP0021	SATA 6Gb/s	MLC
400GB	ST400FP0021	SATA 6Gb/s	MLC
240GB	ST240FP0021	SATA 6Gb/s	MLC
200GB	ST200FP0021	SATA 6Gb/s	MLC
120GB	ST120FP0021	SATA 6Gb/s	MLC
100GB	ST100FP0021	SATA 6Gb/s	MLC

## Pulsar.2™

The Seagate Pulsar.2 drive delivers the price-performance, data integrity and endurance benefits for performance-hungry enterprise applications.

### Key Advantages

- Best-in-class MLC endurance (up to 10 full drive writes/day)
- Price-performance and reliability benefits
- Protects against unintended data change or loss—ensuring data integrity
- Provides the same feature set to look, feel and act like an enterprise hard drive—reducing system complexity and operating costs

### Best-Fit Applications

- Tier 0, performance-hungry enterprise applications—virtualization, OLTP, data warehousing and cloud computing
- Blade servers, general servers and direct-attached storage
- Enterprise architectures using auto-tiering



CAPACITY <sup>1</sup>	MODEL	INTERFACE	FULL DRIVE WRITES/DAY <sup>2</sup>
800GB	ST800FM0002	6Gb/s SAS	10
800GB	ST800FM0012 <sup>3</sup>	6Gb/s SAS	10
400GB	ST400FM0002	6Gb/s SAS	10
400GB	ST400FM0012	SATA 6Gb/s	10
200GB	ST200FM0002	6Gb/s SAS	10
200GB	ST200FM0012	SATA 6Gb/s	10
100GB	ST100FM0002	6Gb/s SAS	10
100GB	ST100FM0012	SATA 6Gb/s	10

## 1200 SSD


The Seagate 1200 SSD delivers best-in-class performance and a rich enterprise feature set for demanding data center applications.

### Key Advantages

- Helps remove storage bottlenecks and close the gap between processor and data access performance
- Delivers the speed and performance consistency needed for demanding enterprise applications
- Designed to reduce data access wait times under the most complex, write-intensive workloads
- Ensures data availability for critical production systems by using redundant, failover I/O communication paths

### Best-Fit Applications

- Demanding enterprise applications with complex, write-intensive and mixed workloads
- IOPS-hungry enterprise applications, such as high-performance computing, online transaction processing and heavy data analytics
- External enterprise storage solutions (SAN, NAS, DAS)



CAPACITY <sup>1</sup>	MODEL	INTERFACE	NAND FLASH TYPE
800GB	ST800FM0053 <sup>2</sup>	SATA 12Gb/s	MLC
800GB	ST800FM0063 <sup>2,3</sup>	SATA 12Gb/s	MLC
400GB	ST400FM0073 <sup>2</sup>	SATA 12Gb/s	MLC
200GB	ST200FM0073 <sup>2</sup>	SATA 12Gb/s	MLC

## X8 Accelerator

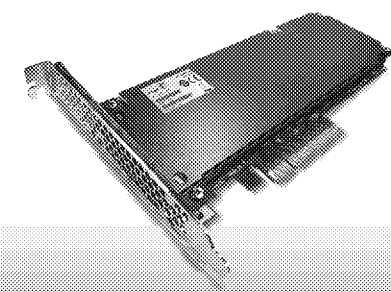
The Seagate X8 Accelerator, powered by Virident, delivers DRAM-like performance and high capacity in a low-profile and highly scalable PCIe card.

### Key Advantages

- Provides up to 1.1M IOPS with access latencies under 20µs
- Delivers up to 2x higher performance than the closest competitor
- Uses high-bandwidth, low-latency, 8-lane PCIe 2.0 to handle data growth and increased traffic
- Ensures scalability with a single storage image, scalable in increments up to 2.2TB

### Best-Fit Applications

- Virtualized desktop infrastructures (VDI)
- Oracle enterprise server applications
- MySQL applications
- Microsoft SQL Server applications
- VMware applications



MAX CAPACITY MODE <sup>1</sup>	MAX PERFORMANCE MODE <sup>1</sup>	MODEL	FLASH MEMORY TYPE
2222GB	1847GB	ST2200FS0000	MLC
1111GB	923GB	ST1100FS0000	MLC
1111GB	923GB	ST1100FR0000	MLC
555GB	461GB	ST550FR0000	MLC

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Encrypting Drives (SED) and PPS 140-2 Validated drives are not available in all models or countries.

May require TCG-compliant host or controller support.

<sup>3</sup> PPS 140-2 in review. See PPS 140-2 Level 2 Certificate at <http://www.seagate.com/group/STAM/revp/certificate.html>

<sup>4</sup> Usable Capacity in Max Capacity mode (default)

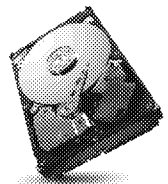
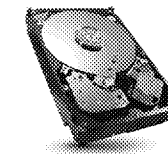
<sup>5</sup> Usable Capacity in Max Performance mode



# Video Storage Solutions

## Storage solutions for DVRs and surveillance systems

Seagate has the global presence to provide the supply and support for CE integrators as well as a complete business and technology partnership for the video storage market.



	VIDEO 3.5 HDD	VIDEO 2.5 HDD	SV35 SERIES™
Application	Mainstream CE-DVR	Small form factor CE-DVR	Video Surveillance
Description	Cool, quiet, low-power performance—perfect for high-definition consumer DVR applications	Cool, quiet, low power—perfect for small form factor and power-sensitive designs	Optimized performance, power savings and improved reliability for video surveillance applications
Form Factor	3.5-inch	2.5-inch	3.5-inch
Simultaneous HD Streams Supported	up to 16	up to 12	—
Reliability (AFR)	0.55%	0.55%	<1%
Max. Ext. Transfer Rate	300MB/s to 600MB/s	300MB/s	600MB/s
Capacity <sup>1</sup>	250GB to 4TB	250GB to 500GB	1TB to 3TB
Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 3Gb/s	SATA 6Gb/s
Cache	8MB to 64MB	16MB	64MB
Power (Idle)	2.5W to 4.5W	0.66W	3.36W to 5.4W (Idle2)
Product	Video 3.5 HDD	Video 2.5 HDD	SV35 Series
SATA Interface	x	x	x
Low Power	x	x	
Quiet Acoustics	x	x	
Cool Operation	x	x	x
Sustainable Technology	x	x	
Best-in-Class Performance	x	x	x
Capacity Leadership	x	x	
24x7 Operation Capable	x	x	x
Extremely Low Vibration	x	x	

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity

## Video 3.5 HDD

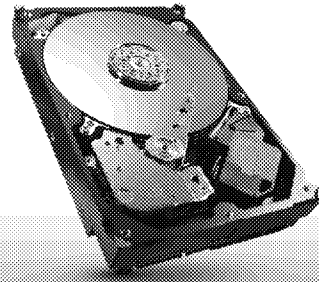
Seagate Video 3.5 HDDs deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

### Key Advantages

- Quiet drive operation to enhance customer viewing and listening experiences
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

### Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000VM000	SATA 6Gb/s	64MB
3TB	ST3000VM002	SATA 6Gb/s	64MB
2TB	ST2000VM003	SATA 6Gb/s	64MB
1TB	ST1000VM002	SATA 6Gb/s	64MB
500GB	ST3500312CS	SATA 3Gb/s	8MB
320GB	ST3320311CS	SATA 3Gb/s	8MB
250GB	ST3250312CS	SATA 3Gb/s	8MB

## SV35 Series™

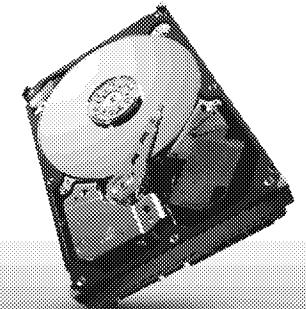
The Seagate SV35 series drives optimize performance, save power and improve reliability for video surveillance applications.

### Key Advantages

- Higher areal density for cost-effective DVR applications
- Performance-tuned for seamless video applications
- Enterprise-class reliability for 24x7 video surveillance applications
- Built-in error recovery for non-stop streaming

### Best-Fit Applications

- Video surveillance digital video recorder
- Video surveillance network digital video recorder
- Direct-attached JBOD video surveillance storage
- Network-attached JBOD video storage



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
3TB	ST3000VX000	SATA 6Gb/s	64MB
2TB	ST2000VX000	SATA 6Gb/s	64MB
1TB	ST1000VX000	SATA 6Gb/s	64MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

## Video 2.5 HDD

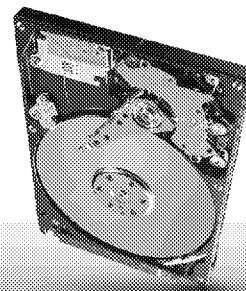
Seagate Video 2.5 HDDs let you stream, record and play back your video content with unparalleled reliability and performance.

### Key Advantages

- Virtually silent streaming performance as low as 19dB
- Built for 24x7 operation and low power consumption
- Small, 2.5-inch form factor allows system cost reduction and operational power savings
- Fanless design allows flexibility in a sleek system design.
- 0.55% AFR supports longevity in demanding consumer electronic environments.

### Best-Fit Applications

- DVR and media center applications
- Home theater PCs
- Karaoke and audio jukeboxes
- Cable, satellite and IPTV set-top boxes
- In-camera or surveillance systems



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
500GB	ST500VT000	SATA 3Gb/s	16MB
320GB	ST320VT000	SATA 3Gb/s	16MB
250GB	ST250VT000	SATA 3Gb/s	16MB

## Partner Resources and Benefits

The Seagate Partner Program (SPP) provides access to unique resources and benefits to help channel partners secure new opportunities and grow revenue and profitability.

As a registered SPP member, you enjoy the following exclusive features:

- Password-protected portal
- E-newsletter and regular news updates
- New product evaluation unit program
- Training and sales tools
- Priority support

**Start reaping the rewards of SPP membership—register today at**  
[www.seagate.com/www/partners](http://www.seagate.com/www/partners)

- Complete the online form.
- Click through and accept our standard agreement.



Partner Program

## Service and Support

For information regarding products and services, visit [www.seagate.com/about/contact-us/technical-support](http://www.seagate.com/about/contact-us/technical-support)

### Available services include:

- Presales and Technical Support
- Global Support Services telephone numbers and business hours
- Authorized Seagate Service Centers

For information regarding Warranty Support, visit [www.seagate.com/support/warranty-and-returns](http://www.seagate.com/support/warranty-and-returns)

For information regarding Data Recovery Services, visit [www.seagate.com/services-software/](http://www.seagate.com/services-software/)

For Seagate OEM and Distribution partner portal, visit [www.seagate.com/www/partners](http://www.seagate.com/www/partners)

For Seagate reseller portal, visit [www.seagate.com/www/partners](http://www.seagate.com/www/partners)



**Seagate Technology LLC**  
10200 South De Anza Boulevard  
Cupertino, California 95014  
408-658-1000

## Exhibit 22



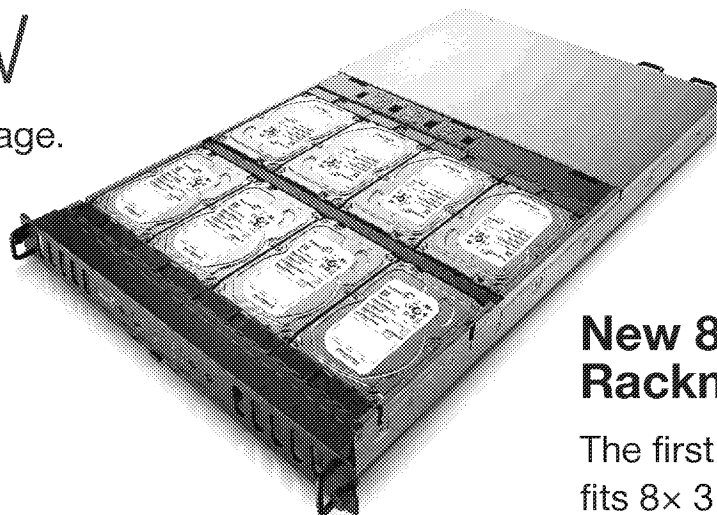


# Storage Solutions Guide

OCTOBER 2013 | AMER

## ROOM TO GROW

Double the storage.  
Half the space.



### **New 8-Bay Rackmount NAS**

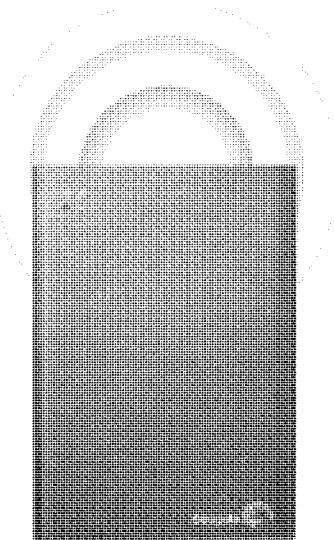
The first 1U rack that  
fits 8x 3.5" drives



Make the perfect gift complete.



Complete your tablet with  
1TB of storage to carry and stream 500+  
movies or thousands of songs.  
No internet required.



Wireless Plus  
Mobile Device Storage



[www.seagate.com](http://www.seagate.com)

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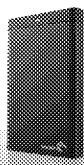
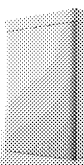
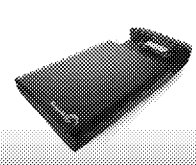

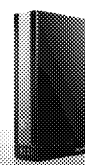
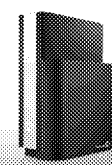

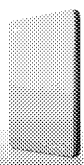
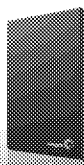
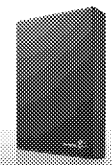
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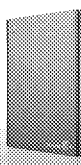
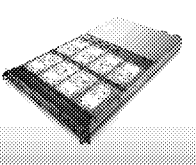
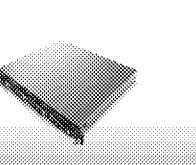
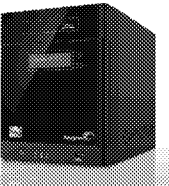


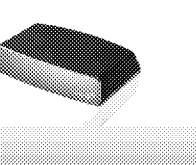
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# External Storage

## At-a-Glance Product Comparison

Direct Attached/ Portable	BACKUP PLUS					SLIM		EXPANSION		
										
	Backup Plus Portable	Backup Plus Portable for Mac	Backup Plus for Mac Portable Thunderbolt™	Backup Plus Desktop	Backup Plus Desktop for Mac	Backup Plus for Mac Desktop Thunderbolt	Slim Portable	Slim Portable for Mac	Expansion Portable	Expansion Desktop
PERFECT FOR	Protecting and sharing digital memories			Keeping your digital life safe and sound		Keeping your digital life safe and sound	Thin storage that fits—and goes—anywhere		Protecting and sharing your digital life	
DESCRIPTION	Store and back up the content on your social networks with these flexible, portable drives. PC or Mac.			These desktop drives provide the simple, one-click way to protect and share files. PC or Mac.		These desktop drives provide the simple, one-click way to protect and share files. Mac.	This ultra-thin metal design is the world's sleekest portable external hard drive. PC or Mac.		Expansion drives allow you to instantly add more storage space to your computer and take large files with you.	
LEARN MORE	Page 5	Page 6	Page 6	Page 8	Page 7	Page 7	Page 9	Page 8	Page 10	Page 9

Wireless Mobile							Network Attached						
	Wireless Plus							Business Storage 8-Bay Rackmount NAS	Business Storage 4-Bay Rackmount NAS	Business Storage 4-Bay NAS	Business Storage 4-Bay NAS	Business Storage 2-Bay NAS	Central
PERFECT FOR	Wireless storage for your tablet						PERFECT FOR	Centralized storage and backup		Centralized storage, collaboration and backup			Wireless centralized home storage
DESCRIPTION	Take your media library on the go and stream it wirelessly to your iPad, Android tablet and smartphone. PC or Mac.						DESCRIPTION	The first 1U rack that fits eight hot-swappable 3.5-inch drives	A complete, high-performance network storage for businesses with up to 100 employees	A complete network storage solution and private cloud for businesses of up to 50 employees.	A complete network storage solution and private cloud for businesses of up to 25 employees.	A complete network storage solution and private cloud for home offices.	This shared storage device automatically backs up multiple Macs and PCs plus streams your shared library to the connected devices in the home.
LEARN MORE	Page 10						LEARN MORE	Page 11	Page 12	Page 12	Page 13	Page 13	Page 11



# External Storage Solutions

Seagate external storage solutions are sleek, dependable and ultra-portable products that let your customers automatically and continuously store digital family photos, protect critical business data, back up multiple computers on a small network, or share and store videos and music.

## Backup Plus

The Backup Plus portable drive is the simple way to protect and share your entire digital life.

### Key Advantages

- Easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Thunderbolt technology or FireWire 800 upgrade allows higher transfer speeds

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.

CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBU1000100	USB 3.0	● Black	PC, Mac
1TB	STBU1000101	USB 3.0	● Silver	PC, Mac
1TB	STBU1000102	USB 3.0	● Blue	PC, Mac
1TB	STBU1000103	USB 3.0	● Red	PC, Mac
750GB	STBU750100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.54-in D (132mm x 46mm x 166mm)			



<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.

# Backup Plus for Mac

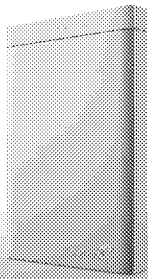
The Backup Plus portable drive for Mac is the simple way to protect and share your entire digital life.

## Key Advantages

- Mac OS and Time-Machine ready out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click.
- Easily increase transfer speeds by upgrading to Thunderbolt technology.

## Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBW1000900	USB 3.0	● Silver/ ○ White	Mac, PC
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 0.54-in D (132mm x 46mm x 166mm)			

# Backup Plus Desktop for Mac

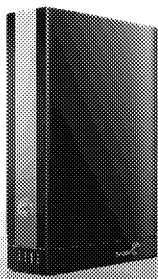
The Backup Plus desktop drive for Mac is the simple, one-click way to protect and share your entire digital life.

## Key Advantages

- Mac OS and Time Machine ready right out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click.
- Up to 3TB capacity for a lifetime of memories

## Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STCB4000901	USB 3.0	● Black/ ● Silver	Mac, PC
3TB	STCB3000900	USB 3.0	● Black/ ● Silver	Mac, PC
2TB	STCB2000900	USB 3.0	● Black/ ● Silver	Mac, PC
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

# Backup Plus for Mac Portable Thunderbolt™


The Thunderbolt Backup Plus for Mac portable drive is everything you need to transfer, store and back up files using Thunderbolt technology.

## Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Compatible with Time Machine software
- Compatible with Thunderbolt devices
- No external power supply required

## Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gbps



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBW1000401	Thunderbolt	● Black	Mac, PC
PRODUCT DIMENSIONS	5.12-in L x 3.19-in W x 1.09-in D (130mm x 81mm x 27.8mm)			
PACKAGE DIMENSIONS	6.69-in L x 5.24-in W x 1.81-in D (170mm x 133mm x 46mm)			

# Backup Plus for Mac Desktop Thunderbolt

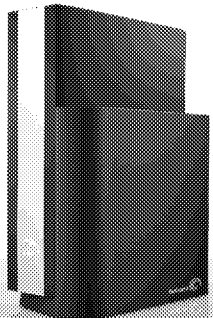
The Thunderbolt Backup Plus for Mac desktop drive is everything you need to transfer, store and back up files using Thunderbolt technology.

## Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Dual ports enable daisy-chaining up to six devices
- Compatible with Thunderbolt displays and other devices
- Compatible with Time Machine softwares

## Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gbps



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
3TB	STCB3000400	Thunderbolt	● Black	Mac, PC
PRODUCT DIMENSIONS	6.61-in L x 4.76-in W x 2.42-in D (168mm x 120.9mm x 61.4mm)			
PACKAGE DIMENSIONS	8.64-in L x 9.13-in W x 3.5-in D (219.5mm x 232mm x 89mm)			



# Backup Plus Desktop

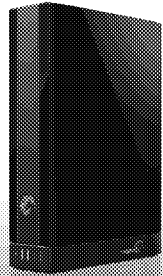
The Backup Plus desktop drive is the simple, one-click way to protect and share your entire digital life.

### Key Advantages

- Easy, flexible, built-in backup options
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Up to 4TB capacity for a lifetime of memories
- Increase transfer speeds by upgrading to Thunderbolt technology or FireWire 800.

### Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STCA4000100	USB 3.0	● Black	PC, Mac
3TB	STCA3000101	USB 3.0	● Black	PC, Mac
2TB	STCA2000100	USB 3.0	● Black	PC, Mac
1TB	STCA1000100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

# Slim

The Seagate Slim portable drive is thin, light and the easiest way yet to back up the things that are important to you.

### Key Advantages

- Just slightly thicker than an iPhone
- Protects your stuff with easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STCD500102	USB 3.0	● Black	PC, Mac
500GB	STCD500104	USB 3.0	● Silver	PC, Mac
PRODUCT DIMENSIONS	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
PACKAGE DIMENSIONS	5.59-in L x 1.22-in W x 4.06-in D (142mm x 31mm x 103mm)			

# Slim for Mac

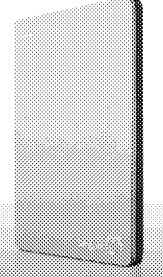
The Seagate Slim portable drive for Mac combines a thin, light form factor in a Time Machine-ready drive.

### Key Advantages

- Just slightly thicker than an iPhone
- Mac OS and Time Machine ready out of the box
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STCF500102	USB 3.0	● Silver	Mac, PC
PRODUCT DIMENSIONS	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
PACKAGE DIMENSIONS	5.59-in L x 1.22-in W x 4.06-in D (142mm x 31mm x 103mm)			

# Expansion

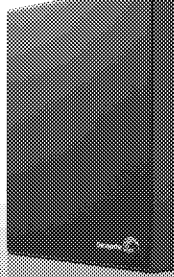
The Expansion desktop drive provides extra storage for your ever-growing collection of files.

### Key Advantages

- Simple and straightforward setup
- No software to install and nothing to configure
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

### Best-Fit Applications

- Instantly add more storage space to your computer.
- Improve performance on your computer's internal drive by freeing up space on your internal drive.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STBV4000100	USB 3.0	● Black	PC
3TB	STBV3000100	USB 3.0	● Black	PC
2TB	STBV2000100	USB 3.0	● Black	PC
1TB	STBV1000100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS	7.07-in L x 4.65-in W x 1.48-in D (179.5mm x 118mm x 37.5mm)			
PACKAGE DIMENSIONS	9.09-in L x 7.97-in W x 2.83-in D (231mm x 202mm x 72mm)			

## Expansion

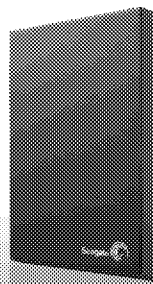
The Expansion portable drive is compact and perfect for taking large files with you on-the-go.

### Key Advantages

- Simple and straightforward setup
- Powered from the USB cable
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

### Best-Fit Applications

- Instantly add more storage space to your computer.
- Take large files with you when you travel.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBX1000101	USB 3.0	● Black	PC
750GB	STBX750100	USB 3.0	● Black	PC
500GB	STBX500100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS (1TB)	5.04-in L x 3.51-in W x 0.87-in D (128.1mm x 89.1mm x 22mm)			
PRODUCT DIMENSIONS (500GB)	4.81-in L x 3.19-in W x 0.61-in D (122.3mm x 81.1mm x 15.5mm)			
PACKAGE DIMENSIONS	5.28-in L x 6.69-in W x 1.89-in D (134mm x 170mm x 48mm)			

## Wireless Plus

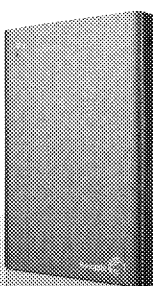
With Wireless Plus mobile device storage, you can take your media library with you. Stream it to your iPad or Android tablet.

### Key Advantages

- Take your media library with you on the go
- Share media with up to eight Wi-Fi enabled devices at the same time
- Use anywhere, without an Internet connection
- Up to 10 hours battery life<sup>3</sup>

### Best-Fit Applications

- Store and carry movies and other media on the go.
- Share media with others.
- Works with iPad or Android tablets and smartphones



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STCK1000100	USB 3.0	● Grey	PC, Mac
PRODUCT DIMENSIONS	5.00-in L x 3.50-in W x 0.78-in D (127mm x 89mm x 19.9mm)			
PACKAGE DIMENSIONS	2.00-in L x 6.02-in W x 7.16-in D (51mm x 153mm x 182mm)			

## Central

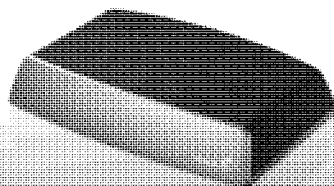
The Central shared network storage system allows you to create secure in-home cloud storage for multiple computers in the home.

### Key Advantages

- Automatically back up multiple PC and Mac computers
- Wirelessly stream your centralized media library to gaming consoles, media players and smart TVs
- Access content on-the-go with a Web browser or the free app for tablets and smartphones

### Best-Fit Applications

- Consolidate content on one easily accessible device
- Back up multiple PC and Mac computers
- Enjoy a centralized media library on smart TVs, game consoles and media players
- Access your content on-the-go with laptops and mobile devices
- Archive your Facebook photos and videos



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STCG4000100	SATA/GigE	● Black	PC, Mac
3TB	STCG3000100	SATA/GigE	● Black	PC, Mac
2TB	STCG2000100	SATA/GigE	● Black	PC, Mac
PRODUCT DIMENSIONS	5.7-in L x 8.5-in W x 1.7-in D (145mm x 216mm x 42mm)			
PACKAGE DIMENSIONS	3.15-in L x 10.3-in W x 9.25-in D (80mm x 261mm x 235mm)			

## Business Storage 8-Bay Rackmount NAS

A complete network storage solution with innovative 8-bay design in a 1U form factor that is perfect for growing businesses

### Key Advantages

- A 2.3GHz dual-core Intel processor delivers file transfer performance of up to 200MB/s
- Wuala™ cloud service and apps for secure collaboration and anywhere access
- Centralized backup for PCs, plus Time Machine support for Mac computers
- Support for iSCSI enables maximum performance and compatibility for virtualized environments

### Best-Fit Applications

- Store business-critical files centrally and securely
- Back up your organization's PC and Mac computers
- Access and manage files remotely using Internet-connected computers and devices
- Back up files to the cloud



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
32TB	STDP32000100	Gigabit Ethernet	Black	PC, Mac
24TB	STDP24000100	Gigabit Ethernet	Black	PC, Mac
16TB	STDP16000100	Gigabit Ethernet	Black	PC, Mac
12TB	STDP12000100	Gigabit Ethernet	Black	PC, Mac
8TB	STDP8000100	Gigabit Ethernet	Black	PC, Mac
PRODUCT DIMENSIONS	30.394-in L x 1.713-in W x 18.78-in D (772mm x 43.5mm x 477mm)			
PACKAGE DIMENSIONS	35.354-in L x 23.465-in W x 8.661-in D (898mm x 596mm x 220mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> U.S. model numbers shown.

<sup>3</sup> Exact battery life subject to product model, normal usage conditions and configurations.

## Business Storage 4-Bay Rackmount NAS

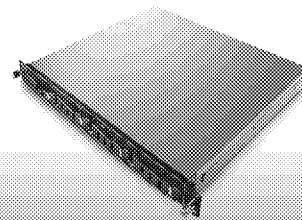
Centralize your storage and backups with a complete network storage solution that saves valuable floor space for small businesses.

### Key Advantages

- Centralized storage and backup for PCs and Macs, plus secure Wuala cloud off-site backup service
- A dual-core Intel Atom processor and new, performance-optimized Seagate NAS OS deliver file transfer speeds up to 200MB/s
- Anywhere access to your files
- Hot-swappable drives and dual Gigabit Ethernet ports help increase up-time

### Best-Fit Applications

- Store business-critical files centrally and securely
- Back up your organization's PC and Mac computers
- Access and manage files remotely using Internet-connected computers and devices
- Back up files to the cloud



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
16TB	STDN16000100	Gigabit Ethernet	● Black	PC, Mac
12TB	STDN12000100	Gigabit Ethernet	● Black	PC, Mac
8TB	STDN8000100	Gigabit Ethernet	● Black	PC, Mac
4TB	STDN4000100	Gigabit Ethernet	● Black	PC, Mac
---	STDN100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	16.929-in L x 15-in W x 1.713-in D (430mm x 381mm x 42.5mm)			
PACKAGE DIMENSIONS	22.44-in L x 19.567-in W x 6.496-in D (570mm x 497mm x 164mm)			

## Business Storage 4-Bay NAS

A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations

### Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0, 1, 5 and 10 configuration options

### Best-Fit Applications

- Make automatic, continuous backups
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected devices
- Create cost-effective, private cloud storage
- Encrypt individual files to entire volumes of data



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
16TB	STBP16000100	Gigabit Ethernet	● Black	PC, Mac
12TB	STBP12000100	Gigabit Ethernet	● Black	PC, Mac
8TB	STBP8000100	Gigabit Ethernet	● Black	PC, Mac
4TB	STBP4000100	Gigabit Ethernet	● Black	PC, Mac
---	STBP100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	6.3-in W x 8.2-in H x 10.2-in D (161.00mm x 208.00mm x 258.50mm)			
PACKAGE DIMENSIONS	9.4-in W x 14.9-in H x 9.4-in D (240.00mm x 379.00mm x 243.00mm)			

## Business Storage 2-Bay NAS

Create a private cloud to help protect your business-critical data and centralize files in a single location you can access from anywhere

### Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0 and 1 configuration options

### Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
8TB	STBN8000100	Gigabit Ethernet	● Black	PC, Mac
6TB	STBN6000100	Gigabit Ethernet	● Black	PC, Mac
4TB	STBN4000100	Gigabit Ethernet	● Black	PC, Mac
---	STBN100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	4.1-in W x 8.0-in H x 8.9-in D (104.50mm x 204.00mm x 227.00mm)			
PACKAGE DIMENSIONS	6.2-in W x 10.9-in H x 12.5-in D (157.00mm x 277.00mm x 317.00mm)			

## Business Storage 1-Bay NAS

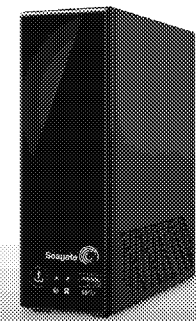
Create a private cloud with Seagate Business Storage 1-Bay NAS. It helps protect your all-important data and centralizes your files in a single location you can access from anywhere.

### Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Stream your media library to networked computers, Internet TVs, game consoles and more

### Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage

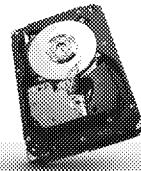

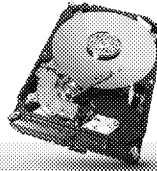
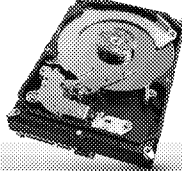
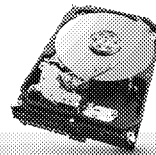
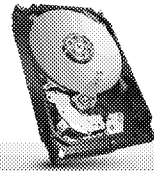
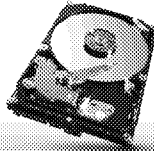
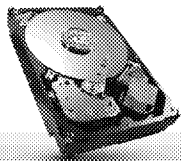




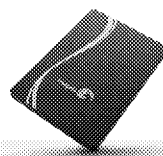


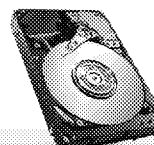

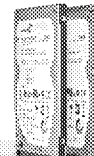




CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STBM4000100	Gigabit Ethernet	● Black	PC, Mac
3TB	STBM3000100	Gigabit Ethernet	● Black	PC, Mac
2TB	STBM2000100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	2.4-in W x 6.9-in H x 5.8-in D (61mm x 176mm x 148mm)			
PACKAGE DIMENSIONS	3.7-in W x 9.3-in H x 9.0-in D (93mm x 236mm x 229mm)			



# Internal Storage

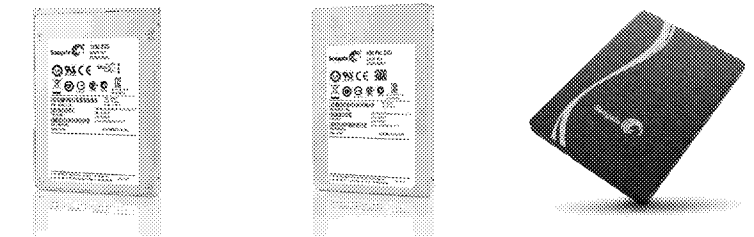
## At-a-Glance Product Comparison

	ENTERPRISE			DESKTOP		SPECIALTY		
3.5-inch								
	Cheetah® 15K	Enterprise Capacity 3.5 HDD	TeraScale™ HDD	Desktop SSHD	Desktop HDD	NAS HDD	SV35 Series™	Video 3.5 HDD
USE THIS DRIVE FOR	High-capacity, compute-intensive requirements demanding high performance and availability	Bulk-data applications requiring reliable, highest-capacity storage efficiency and enterprise-class reliability	Cost-effective, low-power bulk storage solutions for unstructured data	Desktop solutions requiring SSD-like performance and massive capacities at an affordable price	Desktop compute where choice in capacity and cache options to provide design flexibility is important	Small NAS systems needing performance with high capacities. 3-year limited warranty	Surveillance systems that require high performance, low power and centralized storage or every surveillance application. 3-year limited warranty	DVR systems where reliable, low-power, purpose-built storage is required for video streaming applications. 3-year limited warranty
ENCRYPTION MODELS AVAILABLE	X	X						
LEARN MORE	Page 25	Page 26	Page 28	Page 32	Page 32	Page 42	Page 42	Page 43

	SSD			ENTERPRISE SSHD	ENTERPRISE		MOBILE			SPECIALTY		
2.5-inch												
	1200 SSD	600 Pro SSD	600 SSD	Enterprise Turbo SSHD	Enterprise Performance 15K HDD	Enterprise Performance 10K HDD	Constellation®	Laptop SSHD and Laptop Thin SSHD	Momentus® Thin	Laptop Ultrathin HDD	Ultra Mobile HDD	Video 2.5 HDD
USE THIS DRIVE FOR	Enterprise storage environments requiring high-capacity SSD with data integrity and drive endurance	Data center and cloud applications that require fast performance and low power	On-the-go users who need the fastest performance and improved ruggedness	Improved storage performance tier between SSDs and high-capacity HDDs	Compute-intensive data requirements demanding the highest HDD performance density and availability	Mainstream data requiring high capacity, performance density and reliability	Online reference data demands requiring cost-effective, low-power, enterprise-class drives	The ultimate mobile computing experience, with SSD-like performance for all applications and OS environments	Slim computing devices, such as laptops and netbooks	Slim laptops and devices that need light, affordable, high-capacity storage	Robust storage for high-capacity tablets and mobile applications	Video streaming where 24x7 operation, small form factor and low power consumption are needed, 3-year limited warranty
ENCRYPTION MODELS AVAILABLE			X	X	X	X	X		X	X		
LEARN MORE	Page 18	Page 18	Page 19	Page 22	Page 22	Page 24	Page 27	Page 36	Page 36	Page 37	Page 37	Page 43

# Solid State Drive Solutions

Seagate is committed to the flash-based storage market, as is evident by its line of enterprise and client SSDs, engineered to deliver ultra-fast speed and high data integrity. Seagate is focused on the continuing technology leadership that allows it to be a premier supplier of both solid state drives and hard drives.



	1200 SSD	600 Pro SSD	600 SSD
Legacy Name			
Description	Ultra-fast, consistent performance for demanding enterprise storage and server applications	Fast performance and low power for performance-hungry data center and cloud applications	Speed up your laptop with SSD performance and ruggedness
Form Factor/z-Height	2.5-inch/7mm	2.5-inch/7mm	2.5-inch/5mm, 7mm
Reliability	0.44% AFR	0.58% AFR	0.58% AFR
Capacity <sup>1</sup>	200GB to 800GB	100GB to 480GB	120GB to 480GB
Endurance (total terabytes written over warranty period)	3650TBW to 14,600TBW	24TBW to 1080TBW	36.5TBW to 73TBW
NAND Flash Type	MLC	MLC	MLC
Power (idle)	2.72W to 3.0W	1.05W to 1.25W	1.1W
Interface	12Gb/s SAS	SATA 6Gb/s	SATA 6Gb/s
Limited Warranty <sup>4</sup>	5 years	5 years	3 years
Product	1200 SSD	600 Pro SSD	600 SSD
Self-Encrypting Drive (SED) Option <sup>2</sup>	X		
FIPS 140-2 SED Option <sup>3,4</sup>	X		
Power Loss Data Protection	X	X	

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Encrypting Drive models may require TCG- compliant host or controller support.

<sup>3</sup> Some FIPS in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/ST/owp/documents/140-1/1401vnd.htm>.

<sup>4</sup> Warranty terms may vary based on usage. Consult your Seagate sales representative for warranty terms and conditions.



# 1200 SSD


The Seagate 1200 SSD delivers best-in-class performance and a rich enterprise feature set for demanding data center applications.

## Key Advantages

- Helps remove storage bottlenecks and close the gap between processor and data access performance
- Delivers the speed and performance consistency needed for demanding enterprise applications
- Designed to reduce data access wait times under the most complex, write-intensive workloads
- Ensures data availability for critical production systems by using redundant, failover I/O communication paths

## Best-Fit Applications

- Demanding enterprise applications with complex, write-intensive and mixed workloads
- IOPS-hungry enterprise applications, such as high-performance computing, online transaction processing and heavy data analytics
- External enterprise storage solutions (SAN, NAS, DAS)



CAPACITY <sup>1</sup>	MODEL	INTERFACE	NAND FLASH TYPE
800GB	ST800FM0053 <sup>2</sup>	SATA 12Gb/s	MLC
800GB	ST800FM0063 <sup>2,3</sup>	SATA 12Gb/s	MLC
400GB	ST400FM0073 <sup>2</sup>	SATA 12Gb/s	MLC
200GB	ST200FM0073 <sup>2</sup>	SATA 12Gb/s	MLC

# 600 SSD

The ultimate performance upgrade for existing laptops, the Seagate 600 SSD is a fast, rugged, 2.5-inch, SATA 6Gb/s solid state drive.

## Key Advantages

- Nearly 4× faster boot times and over 2× faster application load times than typical laptop HDDs
- Significantly reduces the amount of time end users must wait before using their devices
- Allows end users to access data faster and to take advantage of superior laptop responsiveness
- The ultimate upgrade drive for road warriors, power users, executives and gamers—work and play faster

## Best-Fit Applications

- Performance upgrade for existing laptops with 2.5-inch hard drives
- Improved ruggedness upgrade for existing laptops that may be dropped while operating
- Data center caching



CAPACITY <sup>1</sup>	7MM 2.5-HT MODEL	INTERFACE	NAND FLASH TYPE
480GB	ST480HM000	SATA 6Gb/s	MLC
240GB	ST240HM000	SATA 6Gb/s	MLC
120GB	ST120HM000	SATA 6Gb/s	MLC

CAPACITY <sup>1</sup>	5MM 2.5-HT MODEL	INTERFACE	NAND FLASH TYPE
480GB	ST480HM001	SATA 6Gb/s	MLC
240GB	ST240HM001	SATA 6Gb/s	MLC
120GB	ST120HM001	SATA 6Gb/s	MLC

# 600 Pro SSD

A class above client SSDs, Seagate 600 Pro SSDs deliver a best-in-class combination of fast, consistent performance and low power.

## Key Advantages

- Delivers the highest IOPS/watt to improve system performance and reduce power and cooling costs for data center and cloud applications
- Fast, consistent performance and low latency over the warranty period of the drive
- Helps reduce performance gaps between storage I/O and CPU operations

## Best-Fit Applications

- Data center applications (fast data indexing, edge caching)
- Data streaming
- Content delivery networks
- Gaming and software delivery
- Virtualization and other cloud applications



CAPACITY <sup>1</sup>	MODEL	INTERFACE	NAND FLASH TYPE
480GB	ST480FP0021	SATA 6Gb/s	MLC
400GB	ST400FP0021	SATA 6Gb/s	MLC
240GB	ST240FP0021	SATA 6Gb/s	MLC
200GB	ST200FP0021	SATA 6Gb/s	MLC
120GB	ST120FP0021	SATA 6Gb/s	MLC
100GB	ST100FP0021	SATA 6Gb/s	MLC



<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drives (SED) and FIPS 140-2 Validated drives are not available in all models or countries.  
May require TCG-compliant host or controller support.  
<sup>3</sup> FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificates at <http://csrc.nist.gov/groups/STM/cwp/validation.html>



# Enterprise Storage Solutions

With more than 30 years of experience and the broadest storage product portfolio available, Seagate consistently designs, builds and supports industry-leading enterprise hard drives, solid state drives and hybrid drives. Seagate has the global presence, processes and resources to support businesses of all sizes with the highest-quality enterprise storage products.



	ENTERPRISE TURBO SSHD	ENTERPRISE PERFORMANCE HDD	CHEETAH*	ENTERPRISE CAPACITY HDD	TERASCALE* HDD/CONSTELLATION* CS
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Legacy Name	Savvio®			Constellation	
Application	Highest SFF Performance	SFF Performance and Mainstream	LFF Performance	High Capacity and Low Power	Affordable High Capacity With Low Power
Description	World's fastest hard drive	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 2.5-inch form factor	High-performance, legacy 15K-RPM enterprise hard drive in a 3.5-inch form factor	High-capacity, low-power, reliable 7200-RPM enterprise hard drive in both 2.5- and 3.5-inch form factors	High-capacity, eco-friendly, cost-effective storage for Web-scale data centers
Form Factor	2.5-inch	2.5-inch	3.5-inch	2.5-inch and 3.5-inch	3.5-inch
Reliability	0.44% AFR	0.44% AFR	0.55% AFR	0.62% and 1.095% AFR	800,000 MTBF
Capacity <sup>1</sup>	300GB to 900GB	300GB to 1200GB	300GB to 600GB	250GB to 4TB	1TB to 4TB
Power (Idle)	4.82W to 5.3W	4.4W to 5.3W	8.74W to 11.68W	2.52W to 7.7W	up to 4.59W
Format	5xxE, 4KN	512N, 5xxE, 4KN	512N	512N, 5xxE	512E
Interface	6Gb/s SAS	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, SATA 6Gb/s	SATA 6Gb/s
Limited Warranty <sup>4</sup>	5 years	5 years	5 years	5 years	3 years

## Product Comparison

Product	Enterprise Turbo SSHD	Enterprise Performance 15K HDD	Enterprise Performance 10K HDD	Enterprise Capacity 15K HDD	Enterprise Capacity 7.2K HDD	Enterprise Capacity 5.4K HDD	Enterprise Capacity 3.5 HDD
Vibration Tolerance for Multi-Drive Stabilization	X	X	X	X	X	X	X
PowerChoice™ Optimized Idle Power Settings	X	X	X		X	X	X
Self-Encrypting Drive (SED) <sup>2</sup>	X	X	X	X	X	X	
FIPS 140-2 SED Option <sup>3,4</sup>	X	X	X	X	X	X	
Instant Secure Erase	X	X	X		X	X	X
Solid State Hybrid	X						
Energy-Saving Features	X	X	X		X	X	X
RoHS Compliance	X	X	X	X	X	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models may require TCG compliant host or controller support.  
<sup>3</sup> Some FIPS in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/CTM/comp/documents/f140-1/f1401vend.htm>.  
<sup>4</sup> Warranty terms may vary based on usage. Consult your Seagate sales representative for warranty terms and conditions.



# Enterprise Turbo SSHD

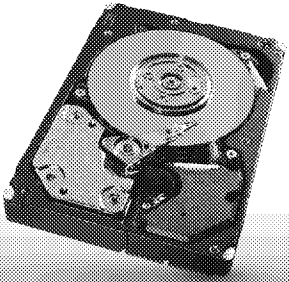
The Enterprise Turbo SSHD accelerates access to your most critical data with the world's fastest hard drive.

### Key Advantages

- Hard drive capacities with flash-based performance
- Best economic combination of performance, endurance and capacity—best \$/IOPS enterprise HDD
- Meets critical demands for performance, scalability, flexibility and high density in a 2.5-inch form factor
- Automatically caches hot data to flash and absorbs write intensity by only promoting hot data
- Nonvolatile cache to enable faster write response time and help ensure data integrity during power loss

### Best-Fit Applications

- Big data analytics
- Databases (ERP and OLTP)
- Virtual desktop infrastructure (VDI)
- Web development and Web page delivery



CAPACITY <sup>1</sup>	5xK EMULATION MODEL	INTERFACE	CACHE
600GB	ST600MX0004	6Gb/s SAS	128MB
600GB	ST600MX0014 <sup>2</sup>	6Gb/s SAS	128MB
600GB	ST600MX0024 <sup>2,3</sup>	6Gb/s SAS	128MB
450GB	ST450MX0004	6Gb/s SAS	128MB
450GB	ST450MX0014 <sup>2</sup>	6Gb/s SAS	128MB
300GB	ST300MX0004	6Gb/s SAS	128MB
300GB	ST300MX0014 <sup>2</sup>	6Gb/s SAS	128MB

CAPACITY <sup>1</sup>	4K NATIVE MODEL	INTERFACE	CACHE
600GB	ST600MX0034	6Gb/s SAS	128MB
600GB	ST600MX0044 <sup>2</sup>	6Gb/s SAS	128MB
600GB	ST600MX0054 <sup>2,3</sup>	6Gb/s SAS	128MB
450GB	ST450MX0034	6Gb/s SAS	128MB
450GB	ST450MX0044 <sup>2</sup>	6Gb/s SAS	128MB
300GB	ST300MX0034	6Gb/s SAS	128MB
300GB	ST300MX0044 <sup>2</sup>	6Gb/s SAS	128MB

# Enterprise Performance 15K HDD

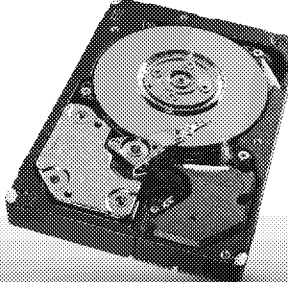
Seagate Enterprise Performance 15K HDDs leverage a 2.5-inch form factor to deliver pronounced performance advantages and power savings over legacy 3.5-inch drives.

### Key Advantages

- Stores 2x the Tier 1 data over previous generation without increasing drive count
- Enables Tier 1 applications to process transactions more quickly
- Best-in-class idle power for more efficient storage operations
- Industry's highest MTBF at 2M hours
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS SED<sup>4</sup> options cut IT drive retirement costs and help protect data at rest.

### Best-Fit Applications

- High-performance Tier 1 enterprise servers
- Blade, rack and tower servers hosting transaction-based applications
- Power- and space-constrained data centers
- Compliance and data security initiatives



CAPACITY <sup>1</sup>	5xK NATIVE MODEL	INTERFACE	CACHE
450GB	ST450MP0004	6Gb/s SAS	128MB
450GB	ST450MP0014 <sup>2</sup>	6Gb/s SAS	128MB
300GB	ST300MP0004	6Gb/s SAS	128MB
300GB	ST300MP0014 <sup>2</sup>	6Gb/s SAS	128MB

CAPACITY <sup>1</sup>	5xK EMULATION MODEL	INTERFACE	CACHE
600GB	ST600MP0034	6Gb/s SAS	128MB
600GB	ST600MP0044 <sup>2</sup>	6Gb/s SAS	128MB
600GB	ST600MP0054 <sup>2,4</sup>	6Gb/s SAS	128MB
450GB	ST450MP0034	6Gb/s SAS	128MB
450GB	ST450MP0044 <sup>2</sup>	6Gb/s SAS	128MB
300GB	ST300MP0034	6Gb/s SAS	128MB
300GB	ST300MP0044 <sup>2</sup>	6Gb/s SAS	128MB

CAPACITY <sup>1</sup>	4K NATIVE MODEL	INTERFACE	CACHE
600GB	ST600MP0064	6Gb/s SAS	128MB
600GB	ST600MP0074 <sup>2</sup>	6Gb/s SAS	128MB
600GB	ST600MP0084 <sup>2,4</sup>	6Gb/s SAS	128MB
450GB	ST450MP0064	6Gb/s SAS	128MB
450GB	ST450MP0074 <sup>2</sup>	6Gb/s SAS	128MB
300GB	ST300MP0064	6Gb/s SAS	128MB
300GB	ST300MP0074 <sup>2</sup>	6Gb/s SAS	128MB



<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drives (SED) and FIPS 140-2 validated drives are not available in all models or countries. May require TCG compliant host or controller support.  
<sup>3</sup> FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/csrc/documents/140-3/1403v2011.htm#1605>.  
<sup>4</sup> FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/csrc/validated.htm#605>.

## Enterprise Performance 10K HDD

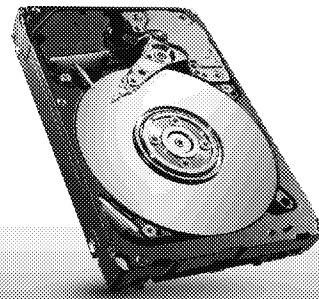
Seagate Enterprise Performance 10K HDDs deliver the optimal balance of capacity, performance and power in a 10K-RPM, 2.5-inch enterprise drive.

### Key Advantages

- Highest-capacity enterprise SFF hard drive (up to 1.2TB)
- PowerChoice™ technology reduces power consumption.
- Protection Information (PI) detects corruption of data in flight between the host system and the drive<sup>4</sup>
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data at rest. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Mission-critical servers and external storage arrays
- Power- and space-constrained data centers
- Compliance or data security initiatives



CAPACITY <sup>1</sup>	5xx NATIVE MODEL	INTERFACE	CACHE
1200GB	ST1200MM0017 <sup>2</sup>	6Gb/s SAS	64MB
1200GB	ST1200MM0027 <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST900MM0026 <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST900MM0036 <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST9900805SS	6Gb/s SAS	64MB
900GB	ST9900705SS <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST9900805SS <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST9900805FC	4Gb/s FC	64MB
600GB	ST600MM0026 <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600205SS	6Gb/s SAS	64MB
600GB	ST9600105SS <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600005SS <sup>2,3</sup>	6Gb/s SAS	64MB
600GB	ST9600205FC	4Gb/s FC	64MB
450GB	ST450MM0026 <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450405SS	6Gb/s SAS	64MB
450GB	ST9450305SS <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450205SS <sup>2,3</sup>	6Gb/s SAS	64MB
450GB	ST9450405FC	4Gb/s FC	64MB
300GB	ST300MM0026 <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300605SS	6Gb/s SAS	64MB
300GB	ST9300505SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300405SS <sup>2,3</sup>	6Gb/s SAS	64MB
300GB	ST9300605FC	4Gb/s FC	64MB

## Cheetah® 15K

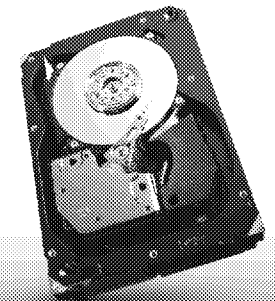
The Seagate Cheetah 15K drive provides high performance and reliability in legacy 3.5-inch mission-critical storage.

### Key Advantages

- Sustained data rate of up to 204MB/s
- Industry's highest 3.5-inch drive reliability
- PowerTrim™ technology optimizes power consumption
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Business and transaction processing
- Email and decision support
- Storage Area Networks (SAN)
- Network Attached Storage (NAS)
- Internet and e-commerce



CAPACITY	5xx NATIVE MODEL	INTERFACE	CACHE
600GB	ST3600057SS	6Gb/s SAS	16MB
600GB	ST3600957SS <sup>2</sup>	6Gb/s SAS	16MB
600GB	ST3600857SS <sup>2,3</sup>	6Gb/s SAS	16MB
600GB	ST3600057FC	4Gb/s FC	16MB
450GB	ST3450857SS	6Gb/s SAS	16MB
450GB	ST3450757SS <sup>2</sup>	6Gb/s SAS	16MB
450GB	ST3450657SS <sup>2,3</sup>	6Gb/s SAS	16MB
450GB	ST3450857FC	4Gb/s FC	16MB
300GB	ST3300657SS	6Gb/s SAS	16MB
300GB	ST3300557SS <sup>2</sup>	6Gb/s SAS	16MB
300GB	ST3300457SS <sup>2,3</sup>	6Gb/s SAS	16MB
300GB	ST3300657FC	4Gb/s FC	16MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Encrypting Drive (SED) and FIPS 140-2 Validated drives are not available in all models or countries.

May require TCG-compliant host or controller support.

<sup>3</sup> FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cwp/documents/140-1/1401val2011.htm#1035>

<sup>4</sup> Protection Information (PI) feature requires PI compliant host or controller support.



## Enterprise Capacity 3.5 HDD

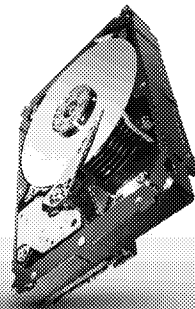
The Seagate Enterprise Capacity 3.5 HDDs help data centers meet the demanding growth of unstructured data.

### Key Advantages

- Highest-capacity enterprise drive for maximum density server and storage solutions
- SAS and SATA interfaces with 24x7 reliability
- Predictable 7200-RPM performance even in the most rugged multi-drive environments
- Improved power and cooling efficiencies with low power consumption and on-demand PowerChoice™ technology
- Protect your data and ease data disposal costs and management with the Self-Encrypting Drive (SED) and FIPS 140-2 certified SED<sup>2,3</sup>

### Best-Fit Applications

- High-capacity RAID storage
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance



CAPACITY <sup>1</sup>	5xx NATIVE MODEL	INTERFACE	CACHE
4TB	ST4000NM0033	SATA 6Gb/s	128MB
4TB	ST4000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
4TB	ST4000NM0073 <sup>2,3</sup>	SATA 6Gb/s	128MB
4TB	ST4000NM0023	6Gb/s SAS	128MB
4TB	ST4000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
4TB	ST4000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB
3TB	ST3000NM0033	SATA 6Gb/s	128MB
3TB	ST3000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
3TB	ST3000NM0023	6Gb/s SAS	128MB
3TB	ST3000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
3TB	ST3000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB
2TB	ST2000NM0033	SATA 6Gb/s	128MB
2TB	ST2000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
2TB	ST2000NM0023	6Gb/s SAS	128MB
2TB	ST2000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
2TB	ST2000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB
1TB	ST1000NM0033	SATA 6Gb/s	128MB
1TB	ST1000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
1TB	ST1000NM0023	6Gb/s SAS	128MB
1TB	ST1000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
1TB	ST1000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB

## Constellation®

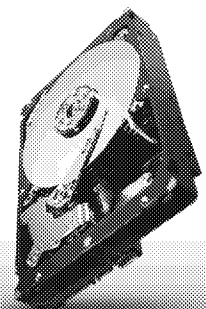
The Seagate Constellation drive is the only 2.5-inch enterprise-class hard drive delivering both 1TB capacities and enterprise reliability.

### Key Advantages

- Maximizes data center footprint
- Energy-efficient storage at under 3.9W (idle)
- Highest nearline reliability with an MTBF of 1.4M hours
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data.
- FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Storage-hungry business applications
- Storage area networks and network attached storage
- Maximum-capacity servers and blade servers
- Rich media content storage
- Enterprise backup and restore—D2D, virtual tape
- Cloud computing



CAPACITY <sup>1</sup>	5xx NATIVE MODEL	INTERFACE	CACHE
1TB	ST91000640NS	SATA 6Gb/s	64MB
1TB	ST91000641NS <sup>2</sup>	SATA 6Gb/s	64MB
1TB	ST91000642NS <sup>2,4</sup>	SATA 6Gb/s	64MB
1TB	ST91000640SS	6Gb/s SAS	64MB
1TB	ST91000641SS <sup>2</sup>	6Gb/s SAS	64MB
1TB	ST91000642SS <sup>2,4</sup>	6Gb/s SAS	64MB
500GB	ST9500620NS	SATA 6Gb/s	64MB
500GB	ST9500621NS <sup>2</sup>	SATA 6Gb/s	64MB
500GB	ST9500622NS <sup>2,4</sup>	SATA 6Gb/s	64MB
500GB	ST9500620SS	6Gb/s SAS	64MB
500GB	ST9500621SS <sup>2</sup>	6Gb/s SAS	64MB
500GB	ST9500622SS <sup>2,4</sup>	6Gb/s SAS	64MB
250GB	ST9250610NS	SATA 6Gb/s	64MB
250GB	ST9250611NS <sup>2</sup>	SATA 6Gb/s	64MB
250GB	ST9250612NS <sup>2,4</sup>	SATA 6Gb/s	64MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Encrypting Drives (SED) and FIPS 140-2 Validated drives are not available in all models or countries. May require TCG compliant host or controller support.

<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cmvp/documents/140-1/1401vend.htm>.

<sup>4</sup> FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cmvp/documents/140-1/1401val02011.htm#1636>.



# Terascale™ HDD Constellation® CS

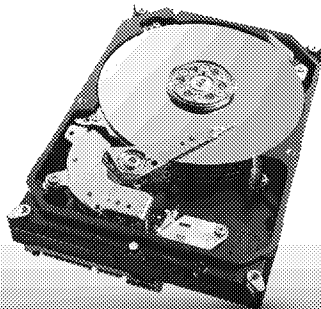
The Seagate Terascale HDD and Constellation CS are designed for large Web-scale data centers where low-cost, low-power and high-capacity storage is critical.

## Key Advantages

- Affordable storage for 24x7 multi-drive replicated environments
- High vibration tolerance for reliable enterprise-class performance
- Low power and cooling costs with the lowest 3.5-inch enterprise drive operating power
- Advanced format logical block management for industry-leading data integrity

## Best-Fit Applications

- Web-scale computing
- Cloud storage servers and arrays
- Cloud backup storage
- Direct-attached external storage (DAS)
- Network-attached storage (NAS)

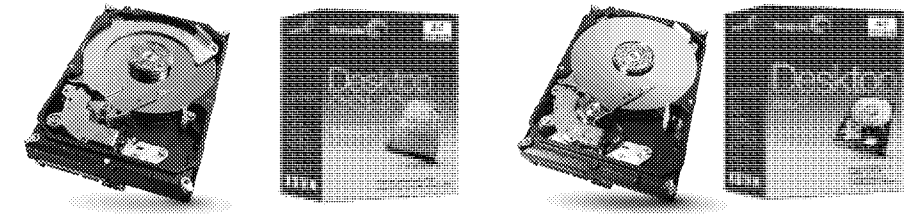


CAPACITY	5xx EMULATION MODEL	INTERFACE	CACHE
4TB	ST4000NC000 <sup>1</sup>	SATA 6Gb/s	64MB
4TB	ST4000NC001	SATA 6Gb/s	64MB
3TB	ST3000NC002	SATA 6Gb/s	64MB
3TB	ST3000NC000 <sup>2</sup>	SATA 6Gb/s	64MB
2TB	ST2000NC001	SATA 6Gb/s	64MB
2TB	ST2000NC000 <sup>2</sup>	SATA 6Gb/s	64MB
1TB	ST1000NC001	SATA 6Gb/s	64MB
1TB	ST1000NC000 <sup>2</sup>	SATA 6Gb/s	64MB



# Desktop Storage Solutions

Seagate has a distinguished history in consistently delivering innovative technologies, super-sized capacities, low power and blazing-fast performance. Seagate desktop drives offer excellent performance at all levels.



	DESKTOP SSHD	DESKTOP SHDD INTERNAL KIT	DESKTOP HDD	DESKTOP 3.5 INCH INTERNAL KIT
Legacy Name			Barracuda®	Barracuda
Application	Performance	Performance	Mainstream	Mainstream
Description	Solid state hybrid drive delivers SSD-like performance without sacrificing capacity	The easy way to upgrade or add storage capacity to desktop computers to get solid state speed for fast, responsive system performance	Tuned performance for low-power, mainstream and high-performance desktop computing	The fast, powerful and easy way to upgrade or add storage capacity to desktop computers
Capacity <sup>1</sup>	1TB to 4TB	1TB to 4TB	250GB to 4TB	500GB to 4TB
Interface	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 3Gb/s, SATA 6Gb/s
Form Factor	3.5 inch	3.5 inch	3.5 inch	3.5 inch
Reliability	<1% AFR	<1% AFR	<1% AFR	<1% AFR
Cache	64MB	64MB	16MB to 64M	16MB to 64M
Power (idle)	<3.3W to <3.9W	<3.3W to <3.9W	4.0W to 5.8W	
Product	Desktop SSHD	Desktop SHDD Internal Kit	Desktop HDD	Desktop 3.5 inch Internal Kit
OptiCache™ Technology			X	X
Solid State Hybrid	X	X		
Mounting Hardware and Cables		X		X
Compatible with Windows 8 <sup>2</sup>	X	X	X	X
Energy-Saving Features	X	X	X	X
RoHS Compliance	X	X	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 8, visit <http://www.seagate.com/en-us/windows/compatibility/win8/CompatCenter/Home>



# Desktop SSHD

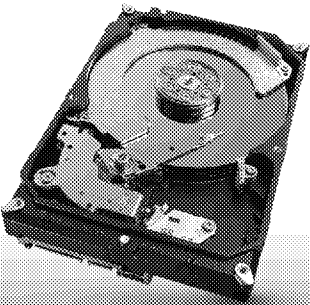
Seagate Desktop SSHD (solid state hybrid drive) delivers SSD-like performance and massive capacities at an affordable price.

## Key Advantages

- First SSHD in a 3.5-inch form factor
- SATA 6Gb/s with NCQ for interface speed
- Up to 3x faster than a traditional HDD<sup>2</sup>
- All-in-one design for ease of installation
- Installs and operates like a standard hard drive
- Massive 1TB or 2TB capacities combined with SSD-like performance<sup>2</sup>

## Best-Fit Applications

- Desktop PCs
- Workstations
- High-performance direct-attached storage (DAS) devices



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST2000DX001	SATA 6Gb/s	64MB
2TB	ST2000DX001	SATA 6Gb/s	64MB
1TB	ST1000DX001	SATA 6Gb/s	64MB

# Desktop 3.5-Inch Internal Kit

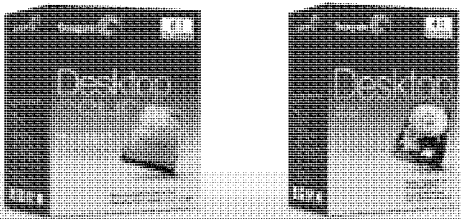
Seagate 3.5-inch internal drives are the fast, powerful, and easy way to upgrade or add storage capacity to desktop computers.

## Key Advantages

- Quiet, ultra-high performance
- DiscWizard™ software makes installation a snap
- Built-in self-monitoring technology helps ensure maximum reliability
- Desktop solid state hybrid model offers SSD-like performance with the capacity of a hard drive

## Best-Fit Applications

- Gaming PCs
- Workstations
- High-end PCs
- Desktop RAID
- Mainstream/office PCs



CAPACITY <sup>1</sup>	KIT NUMBER <sup>3</sup>	INTERFACE	CACHE
4TB	STBD4000400	SATA 6Gb/s	64MB
3TB	STBD3000100	SATA 6Gb/s	64MB
2TB	STBD2000101	SATA 6Gb/s	64MB
1TB	ST310005N1A1AS-RK	SATA 6Gb/s	64MB
500GB	ST3500641AS-RK	SATA 3Gb/s	64MB
PACKAGE DIMENSIONS	7.38-in L x 5.88-in W x 2.88-in D (187mm x 149mm x 73mm)		

DESKTOP SSHD MODEL			
CAPACITY	KIT NUMBER <sup>3</sup>	INTERFACE	MLC FLASH
2TB	STCL2000400	SATA 6Gb/s	8GB
PACKAGE DIMENSIONS	5.88-in L x 7.38-in W x 2.88-in D (149.35mm x 187.45mm x 73.15mm)		

# Desktop HDD

Seagate Desktop HDDs give you the Power of One with 1TB-per-disk technology and one drive platform for every capacity and application.

## Key Advantages

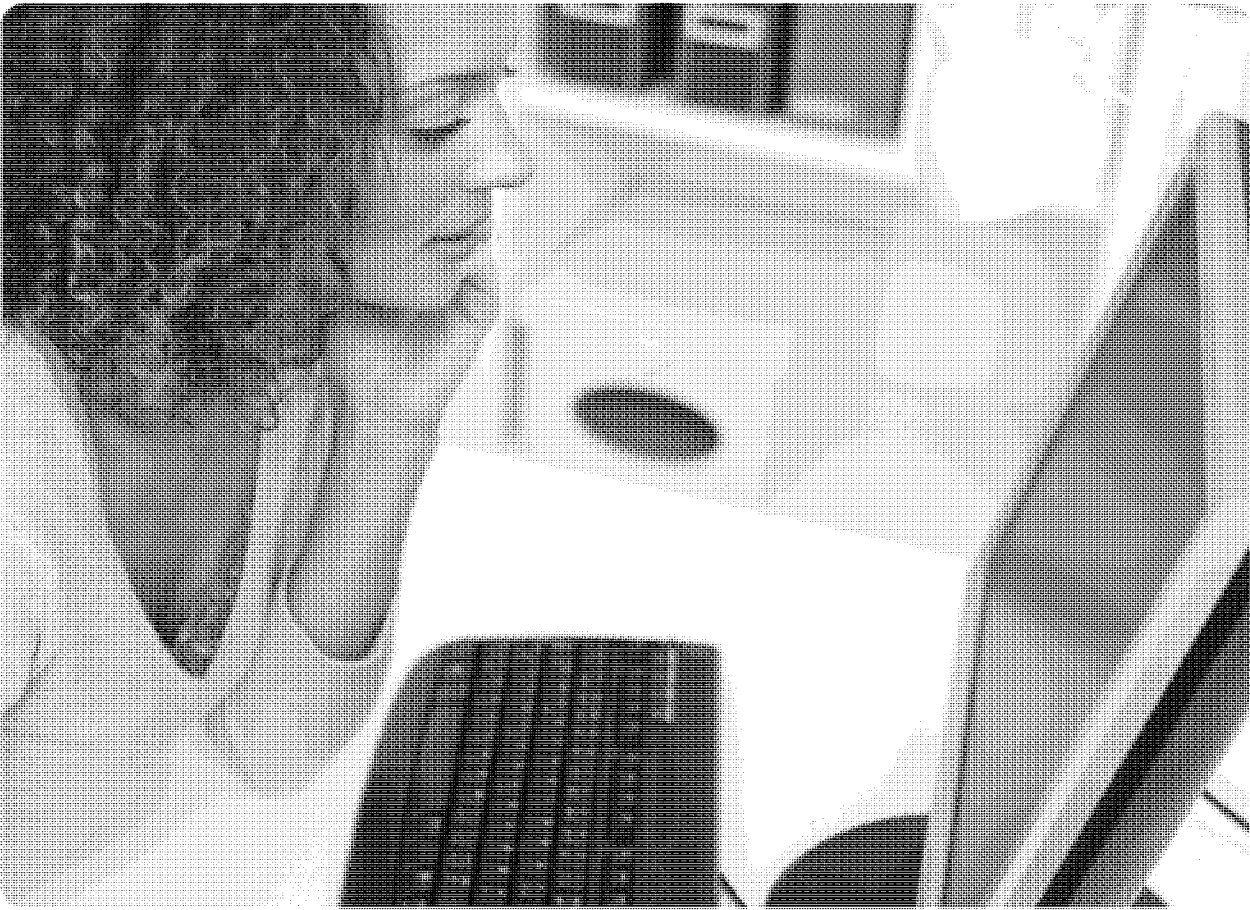
- Up to 4TB capacity
- AcuTrac™ and OptiCache™ technologies deliver dependable overall performance.
- Free Seagate DiscWizard™ software

## Best-Fit Applications

- Desktop or all-in-one PCs and home servers
- PC-based gaming systems
- Direct-attached external storage devices (DAS)



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000DM000	SATA 6Gb/s NCQ	64MB
3TB	ST3000DM001	SATA 6Gb/s NCQ	64MB
2TB	ST2000DM001	SATA 6Gb/s NCQ	64MB
1TB	ST1000DM003	SATA 6Gb/s NCQ	64MB
500GB	ST500DM002	SATA 6Gb/s NCQ	16MB
320GB	ST320DM000	SATA 6Gb/s NCQ	16MB
250GB	ST250DM000	SATA 6Gb/s NCQ	16MB

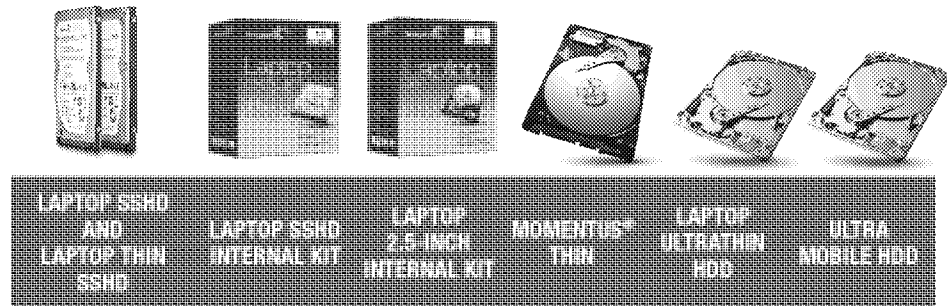


<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Performance may vary depending on user's hardware configuration and operating system.  
<sup>3</sup> U.S. model numbers shown.



# Mobile Storage Solutions

Seagate laptop and tablet drives address every mobile market need, delivering superior performance, reliability and value. Feature-rich with innovative options, the Seagate mobile lineup also includes self-encryption and FIPS 140-2 validated models.



Product Comparison	Legacy Name	Momentus XT	Momentus XT	Momentus Internal Kit		
	Application	Performance	Performance	Performance	Mainstream, Slim Computing	Slim Computing
	Description	Solid state hybrid drives deliver SSD-like performance without sacrificing capacity	The easy way to upgrade or add storage capacity to laptop computers to get solid state speed with capacity of a hard disk drive	A complete upgrade kit to transform your system to high performance or just add capacity	The 2.5-inch drive for laptops and notebooks	Affordable, high-capacity storage that is thinner than a pencil
	Capacity <sup>1</sup>	500GB and 1TB	500GB and 1TB	250GB and 1TB	250GB, 320GB and 500GB	320GB and 500GB
	Interface	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s
	Form Factor/ z-Height	2.5-inch/ 9.5mm, 7mm	2.5-inch/ 9.5mm, 7mm	2.5-inch/9.5mm	2.5-inch/7mm	2.5-inch/5mm
	Reliability	0.48% AFR	0.48% AFR	0.48% AFR	0.48% AFR	
	Cache	64MB	64MB	16MB	16MB	16MB
	Power (Idle)	0.9W	0.9W	0.67W to 0.81W	0.45W	0.48W
	Product	Laptop SSHD and Laptop Thin SSHD	Laptop SSHD Internal Kit	Laptop 2.5-inch Internal Kit	Momentus® Thin	Laptop UltraThin HDD
Feature Comparison	Self-Encrypting Drive (SED) with Instant Secure Erase <sup>2</sup>				X	X
	FIPS 140-2 SED Option <sup>3,4</sup>				X	
	Drop Sensor Options					X
	Solid State Hybrid	X	X			
	Compatible with Windows 8 <sup>4</sup>	X	X	X	X	X
	Energy-Saving Features	X	X		X	X
	RoHS Compliance	X	X	X	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup> Some FIPS in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/comsec/documents/140-1/1401vend.htm>  
<sup>4</sup> For a complete list of Seagate products that are compatible with Windows 8, visit <http://www.microsoft.com/en-us/windows/compatibility/win8/CompatCenter/home>

## Laptop SSHD and Laptop Thin SSHD

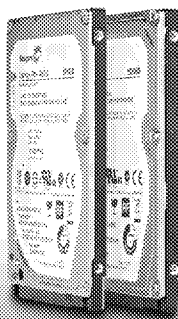
The Seagate Laptop SSHD (1TB) and Laptop Thin SSHD (500GB) enable laptop PC users to enjoy solid state performance without sacrificing capacity.

### Key Advantages

- Boots and performs like an SSD<sup>2</sup>
- Up to 4x faster than a traditional HDD<sup>2</sup>
- SATA 6Gb/s with NCQ for interface speed
- All-in-one design for simplicity and ease of installation
- Works in any laptop or PC, any OS and any application
- Backed by a 3-year limited warranty

### Best-Fit Applications

- Laptops and mobile workstations
- Desktop and tower workstations
- High-performance laptop and desktop gaming systems
- Small form factor all-in-one PCs



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
1TB	ST1000LM014	SATA 6Gb/s	64MB
500GB	ST500LM000	SATA 3Gb/s	64MB

## Laptop Ultrathin HDD

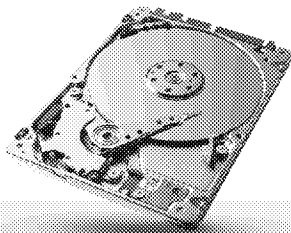
The Seagate Laptop Ultrathin HDD is one of the thinnest and lightest laptop hard drives—5mm, 3.3 oz. and thinner than a pencil.

### Key Advantages

- Affordable, high-capacity storage gives system builder options when integrating low profile storage into slim laptop and ultrabook solutions
- Compatible with every portable PC with a standard SATA 6Gb/s interface
- Get industry-leading cost-per-GB and cost-per-millimeter
- Seagate Secure™ Self-Encrypting Drive options<sup>3</sup>

### Best-Fit Applications

- Slim laptops or ultrabooks
- Extending high-capacity, affordable storage into other applications and slim devices
- Backup storage



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
500GB	ST500LT032	SATA 6Gb/s	16MB
500GB	ST500LT033 <sup>3</sup>	SATA 6Gb/s	16MB
320GB	ST320LT030	SATA 6Gb/s	16MB

## Momentus® Thin


The 7mm, 2.5-inch drive enables slim computing for all types of mobile computing, from laptops to netbooks to smaller desktop PCs.

### Key Advantages

- 7mm z-height form factor enables thin chassis design for all segments of laptop computing.
- Seagate SmartAlign™ technology provides a transition to 4K sectors without the need for software utilities.
- Self-Encrypting Drive<sup>3</sup> options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification<sup>4</sup> are government-approved for the U.S. and Canadian governments.

### Best-Fit Applications

- Thin entry-level laptop PCs
- Thin high-end netbooks
- Thin ultraportables



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
500GB	ST500LT025 <sup>4,5</sup>	SATA 6Gb/s	16MB
500GB	ST500LT015 <sup>4,5</sup>	SATA 6Gb/s	16MB
500GB	ST500LT012	SATA 6Gb/s	16MB
320GB	ST320LT012 <sup>5</sup>	SATA 6Gb/s	16MB
250GB	ST250LT012 <sup>5</sup>	SATA 6Gb/s	16MB

## Ultra Mobile HDD

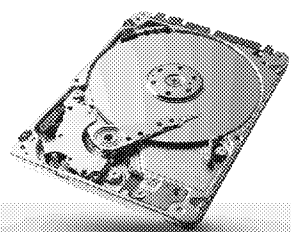
Just 5mm thin and supported by a stainless steel design, the Seagate Ultra Mobile HDD is ready for mobility.

### Key Advantages

- 500GB brings 7x more space to tablet applications at a fraction of the cost.
- Zero-gravity sensors provide extra drop protection.
- Improved shock and tolerance for gyroscopic motion supports even the intense maneuvers of gamers.
- Just 3.3 oz—about the weight of a lightbulb
- Couple with the Seagate Mobile Enablement Kit's Dynamic Data™ Driver for robust and responsive storage with no compromise to system battery life.

### Best-Fit Applications

- Tablets
- Convertible and detachable storage
- Ultra-mobile, ultra-portable storage expansion apps



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
500GB	ST500LT035	SATA 6Gb/s	16MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Performance may vary depending on user's hardware configuration and operating system. Testing performed on a Laptop SSHD 1TB and a Laptop Thin SSHD 500GB.  
<sup>3</sup> Self-Encrypting Drives (SED) are not available in all models or countries. May require TCG-compliant host or controller support.  
<sup>4</sup> See FIPS 140-2 Level 2 Certificate at <http://www.nist.gov/groups/ST/comm/documents/140-2/1401v2nd.htm>  
<sup>5</sup> SmartAlign technology is not available on this model.



# Laptop 2.5-Inch Internal Kit

Seagate 2.5-inch internal drives deliver vast amounts of storage for adding capacity or upgrading drives in laptop computers.

### Key Advantages

- Built for mobility
- Preserves battery life
- Large data cache
- Outstanding performance
- Laptop solid state hybrid model offers SSD-like performance with the capacity of a hard drive.

### Best-Fit Applications

- Replacement laptop drives
- Laptop storage upgrades
- High-end laptops and workstations

2.5-INCH LAPTOP HARD DRIVE			
CAPACITY	MODEL NUMBER	INTERFACE	CACHE
1TB	STBD1000100	SATA 3Gb/s	8MB
500GB	ST905003N3A1AS-RK	SATA 3Gb/s	16MB
500GB	ST905003N1A1AS-RK	SATA 3Gb/s	8MB
250GB	ST90250N1A1AS-RK	SATA 3Gb/s	8MB
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		

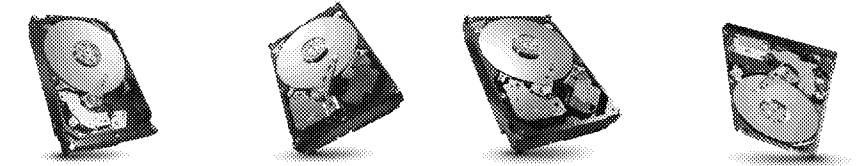
LAPTOP SSD MODEL			
CAPACITY	MODEL NUMBER	INTERFACE	MLC FLASH
1TB	STBD1000400	SATA 6Gb/s	8GB
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		



# Specialty Storage Solutions

Storage solutions for NAS, DVRs and surveillance systems

Seagate has the expertise to build drives optimized for specialty environments, like Network Attached Storage (NAS), CE and video storage. Our global presence, business partnerships, technology leadership and industry understanding enable Seagate to deliver industry-leading products.



	NAS HDD	SV35 SERIES™	VIDEO 3.5 HDD	VIDEO 2.5 HDD
Legacy Name			Pipeline® HD	Pipeline HD Mini
Application	Small NAS	Video Surveillance	Mainstream CE-DVR	Small form factor CE-DVR
Description	Best-performing, highest-capacity storage for 1- to 5-bay NAS systems	Optimized performance and improved reliability for video surveillance applications	Cool, quiet, low-power performance—perfect for high-definition consumer DVR applications	Cool, quiet, low power—perfect for small form factor and power-sensitive designs
Capacity¹	2TB to 4TB	1TB to 3TB	250GB to 4TB	250GB to 500GB
Interface	SATA 6Gb/s	SATA 6Gb/s	SATA 3Gb/s, SATA 6Gb/s	SATA 3Gb/s
Form Factor	3.5-inch	3.5-inch	3.5-inch	2.5-inch
Simultaneous HD Streams Supported	—	—	up to 16	up to 12
Reliability	1M hours MTBF	<1% AFR	0.55% AFR	0.55% AFR
Cache	64MB	64MB	8MB to 64MB	16MB
Power (Idle)	3.0W to 3.95W	3.36W to 5.4W (Idle2)	2.5W to 5.0W	0.66W
Product	NAS HDD	SV35 Series	Video 3.5 HDD	Video 2.5 HDD
Cool Operation		x	x	x
24x7 Operation Capable	x	x	x	x
Extremely Low Vibration	x			
NASWorks™ Technology	x			
Energy-Saving Features	x		x	x
RoHS Compliance	x	x	x	x

¹ One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.



## NAS HDD

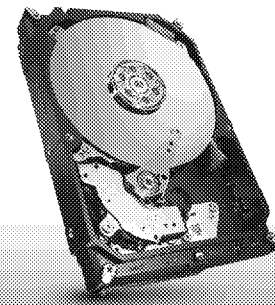
The Seagate NAS HDD fine-tunes the needs of 1- to 5-bay NAS systems to provide industry-leading performance and highest-capacity storage.

### Key Advantages

- NASWorks™ technology supports custom error recovery controls, power management and vibration tolerance.
- NAS error recovery controls help to ensure drives are not dropped from the NAS and sent into a RAID rebuild.
- Improved vibration tolerance and emission in multi-drive systems with dual-plane balance
- Advanced power management supports multiple power profiles for low-power, 24x7 performance.

### Best-Fit Applications

- Home servers or desktop NAS solutions
- Small-business file sharing
- Backup servers



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000VN000	SATA 6Gb/s	64MB
3TB	ST3000VN000	SATA 6Gb/s	64MB
2TB	ST2000VN000	SATA 6Gb/s	64MB

## Video 3.5 HDD

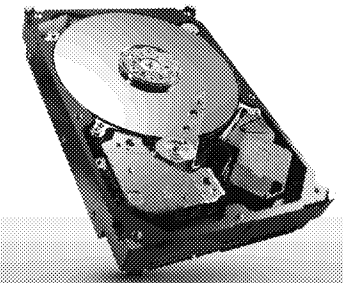
Seagate Video 3.5 HDDs deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

### Key Advantages

- Quiet drive operation to enhance customer viewing and listening experiences
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

### Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000VM000	SATA 6Gb/s	64MB
3TB	ST3000VM002	SATA 6Gb/s	64MB
2TB	ST2000VM003	SATA 6Gb/s	64MB
1TB	ST1000VM002	SATA 6Gb/s	64MB
500GB	ST3500312CS	SATA 3Gb/s	8MB
320GB	ST3320311CS	SATA 3Gb/s	8MB
250GB	ST3250312CS	SATA 3Gb/s	8MB

## SV35 Series™

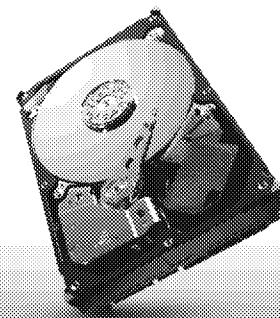
The Seagate SV35 series drives optimize performance, save power and improve reliability for video surveillance applications.

### Key Advantages

- Higher areal density for cost-effective DVR applications
- Performance-tuned for seamless video applications
- Enterprise-class reliability for 24x7 video surveillance applications
- Built-in error recovery for non-stop streaming

### Best-Fit Applications

- Video surveillance digital video recorder
- Video surveillance network digital video recorder
- Direct-attached JBOD video surveillance storage
- Network-attached JBOD video storage



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
3TB	ST3000VX000	SATA 6Gb/s	64MB
2TB	ST2000VX000	SATA 6Gb/s	64MB
1TB	ST1000VX000	SATA 6Gb/s	64MB

## Video 2.5 HDD

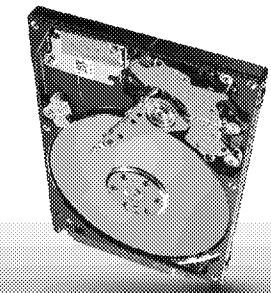
Seagate Video 2.5 HDDs let you stream, record and play back your video content with unparalleled reliability and performance.

### Key Advantages

- Virtually silent streaming performance as low as 19dB
- Built for 24x7 operation and low power consumption
- Small, 2.5-inch form factor allows system cost reduction and operational power savings
- Fanless design allows flexibility in a sleek system design.
- 0.55% AFR supports longevity in demanding consumer electronic environments.

### Best-Fit Applications

- DVR and media center applications
- Home theater PCs
- Karaoke and audio jukeboxes
- Cable, satellite and IPTV set-top boxes
- In-camera or surveillance systems



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
500GB	ST500VT000	SATA 3Gb/s	16MB
320GB	ST320VT000	SATA 3Gb/s	16MB
250GB	ST250VT000	SATA 3Gb/s	16MB

## Partner Resources and Benefits

The Seagate Partner Program (SPP) provides access to unique resources and benefits to help channel partners secure new opportunities and grow revenue and profitability.

As a registered SPP member, you enjoy the following exclusive features:

- Password-protected portal
- E-newsletter and regular news updates
- New product evaluation unit program
- Training and sales tools
- Priority support

**Start reaping the rewards of SPP membership—register today at [www.seagate.com/www/partners](http://www.seagate.com/www/partners)**

- Complete the online form.
- Click through and accept our standard agreement.

 **Seagate**  
Partner Program

## Service and Support

For information regarding products and services, visit [www.seagate.com/about/contact-us/technical-support](http://www.seagate.com/about/contact-us/technical-support)

### Available services include:

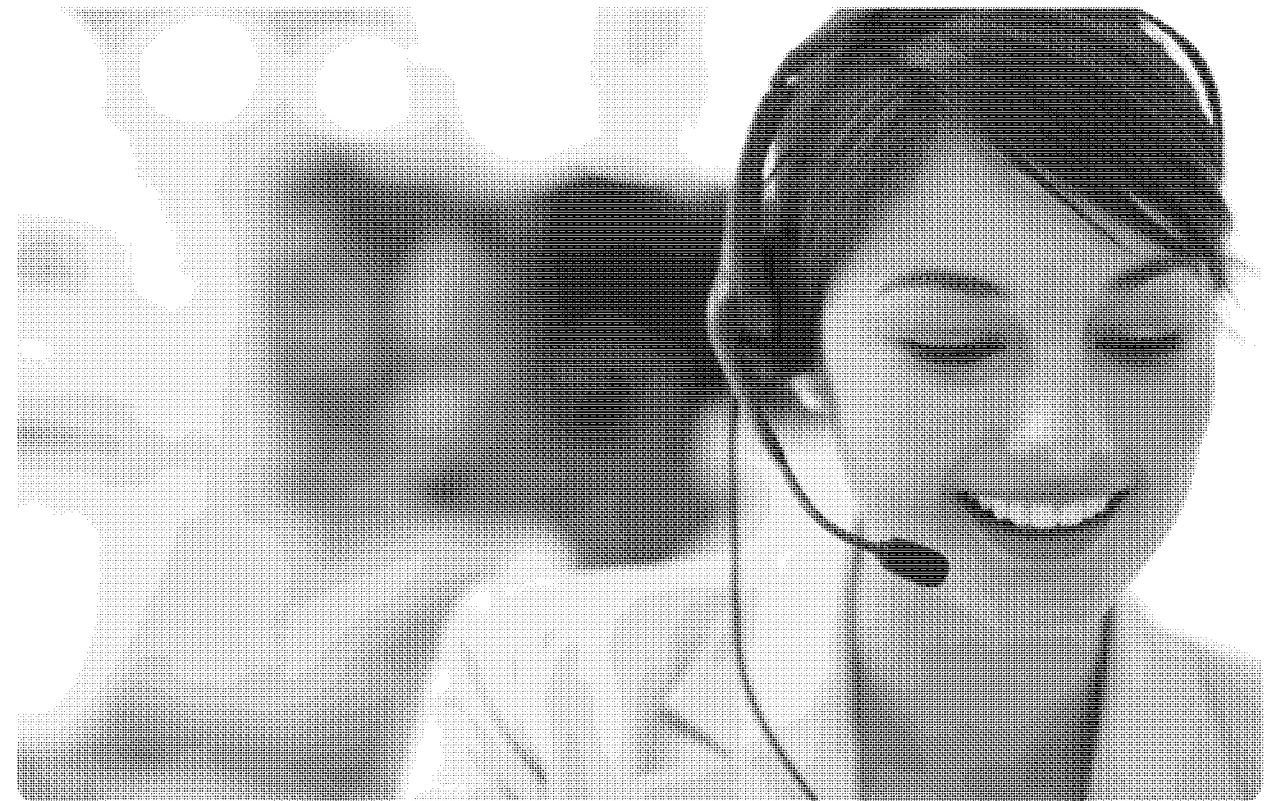
- Presales and Technical Support
- Global Support Services telephone numbers and business hours
- Authorized Seagate Service Centers

For information regarding Warranty Support, visit [www.seagate.com/support/warranty-and-returns](http://www.seagate.com/support/warranty-and-returns)

For information regarding Data Recovery Services, visit [www.seagate.com/services-software/](http://www.seagate.com/services-software/)

For Seagate OEM and Distribution partner portal, visit [www.seagate.com/www/partners](http://www.seagate.com/www/partners)

For Seagate reseller portal, visit [www.seagate.com/www/partners](http://www.seagate.com/www/partners)





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408-658-1000

## Exhibit 23



# Storage Solutions Guide



MAY 2014 | AMER



The Future of Digital  
Video Surveillance Is Here

ENTERPRISE CAPACITY 3.5 HDD

# World's Fastest 6TB Nearline Drive



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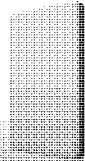

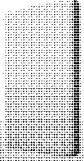
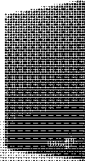
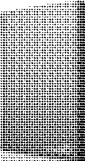
### RESOURCES AND SERVICES


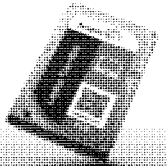
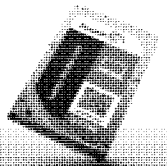

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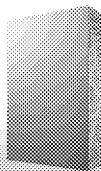
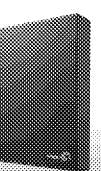




## Choose the best drive for your laptop or mobile device

SEGMENT	External Drives					
PRODUCT						
	Backup Plus Slim Portable	Backup Plus Slim Portable for Mac	Backup Plus Fast Portable	Backup Plus Fast SSD	Expansion Portable	Wireless Plus
PERFECT FOR	Protecting and sharing digital memories		Taking your entire digital library on the go	Editing files right from the drive	Add-on or backup storage	Wireless storage for your tablet
DESCRIPTION	Store and back up the content on your mobile devices and social networks with these portable drives. PC or Mac.		Up to 2× the capacity and performance of other portable drives	High-performance, lightweight portable storage that assists in storing, carrying and sharing content	Expansion drives allow you to instantly add more storage space to your computer and take large files with you.	Take your media library on the go and stream it wirelessly to your iPad, Android tablet and smartphone. PC or Mac.
LEARN MORE	Page 11	Page 11	Page 12	Page 12	Page 13	Page 13

SEGMENT	Internal Drives			
PRODUCT				
	Laptop SSHD, Laptop Thin SSHD and Ultra Mobile SSHD	Laptop Thin HDD	Laptop Ultrathin HDD	Ultra Mobile HDD
PERFECT FOR	Performance	Thin (7mm z-ht.)	Ultrathin (5mm z-ht.)	Ultra-slim tablets (5mm z-ht.)
DESCRIPTION	The ultimate mobile computing experience, with SSD-like performance for all applications and OS environments	Slim computing devices, such as laptops and netbooks	Slim laptops and devices that need light, affordable, high-capacity storage	Robust storage for high-capacity tablets and mobile applications
LEARN MORE	Page 14	Page 14	Page 15	Page 15

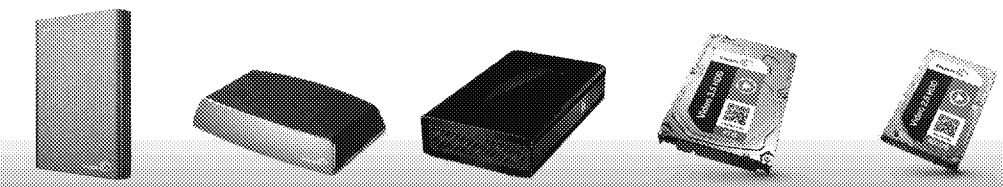
## Choose the best drive for your desktop

SEGMENT	External Drives		
PRODUCT			
	Backup Plus Desktop	Backup Plus Desktop for Mac	Expansion Desktop
PERFECT FOR	Keeping your digital life safe and sound		Add-on or backup storage
DESCRIPTION	These desktop drives provide the simple, one-click way to protect and share files. PC or Mac.		Expansion drives allow you to instantly add more storage space to your computer and take large files with you.
LEARN MORE	Page 17	Page 17	Page 18

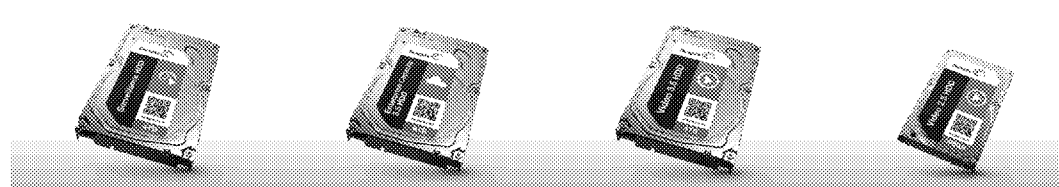
SEGMENT	Internal Drives	
PRODUCT		
	Desktop SSHD	Desktop HDD
PERFECT FOR	Performance	Mainstream
DESCRIPTION	Desktop solutions requiring SSD-like performance and massive capacities at an affordable price	Desktop compute where choice in capacity and cache options to provide design flexibility is important
LEARN MORE	Page 19	Page 19



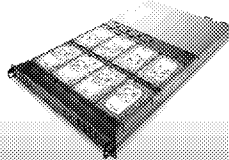
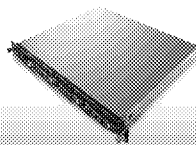


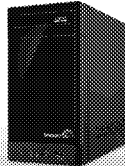

# Choose the best drive for your DVR or video storage

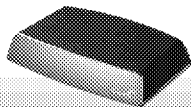


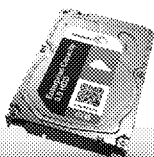
					
PRODUCT	Wireless Plus	Central	DVR Expander	Video 3.5 HDD	Video 2.5 HDD
PERFECT FOR	Wireless storage for your mobile devices	Personal cloud storage	Expanding DVR storage capacity	DVR	DVR
DESCRIPTION	Take your media library on the go and stream it wirelessly to your iPad, Android tablet and smartphone. PC or Mac.	Access your content from anywhere in the world, back up all your computers and stream to your connected devices in the home.	Provides simple, add-on storage that will enable your DVR to store more of your favorite HDTV shows and movies without the hassle of having to delete your favorite content.	DVR systems where reliable, low-power, purpose-built storage is required for video streaming applications. 3-year limited warranty	Video streaming where 24x7 operation, small form factor and low power consumption are needed
LEARN MORE	Page 21	Page 21	Page 22	Page 23	Page 23

# Choose the best drive for your surveillance application









				
PRODUCT	Surveillance HDD	Enterprise Capacity 3.5 HDD	Video 3.5 HDD	Video 2.5 HDD
PERFECT FOR	Surveillance	Centralized surveillance	DVR	DVR
DESCRIPTION	Surveillance systems that require high reliability and streaming capability for centralized storage and surveillance application. 3-year limited warranty	Large centralized or cloud surveillance applications where high levels of video analytics are executed, requiring efficient, enterprise-class reliability	DVR systems or entry-level surveillance applications where reliable, low-power, purpose-built storage is required for video streaming applications	Video streaming or entry-level surveillance systems where 24x7 operation, small form factor and low power consumption are needed
LEARN MORE	Page 25	Page 26	Page 27	Page 27

# Choose the best drive for your network-attached storage

SEGMENT	Business Storage					
PRODUCT						
	Business Storage 8-Bay Rackmount NAS	Business Storage 4-Bay Rackmount NAS	Business Storage 4-Bay NAS	Business Storage Windows Server 4-Bay NAS	Business Storage 2-Bay NAS	Business Storage 1-Bay NAS
PERFECT FOR	Centralized storage, collaboration and backup			Centralized storage, collaboration and backup		
DESCRIPTION	The first 1U rack that fits eight hot-swappable 3.5-inch drives	A complete, high-performance network storage for businesses with up to 100 employees	A complete network storage solution and private cloud for businesses of up to 50 employees.	Makes it easy to expand into a branch office or add local storage to your network by utilizing your existing Windows IT infrastructure.	A complete network storage solution and private cloud for businesses of up to 25 employees.	A complete network storage solution and private cloud for home offices.
LEARN MORE	Page 29	Page 29	Page 30	Page 30	Page 31	Page 31

SEGMENT	Home Network	NAS Internal Drives		
PRODUCT				
	Central	NAS HDD	Terascale™ HDD	Enterprise Capacity 3.5 HDD
PERFECT FOR	Personal cloud storage	Performance	Low Power	High-Density NAS
DESCRIPTION	Access your content from anywhere in the world, back up all your computers and stream to your connected devices in the home.	Small NAS systems needing performance with high capacities	Cost-effective, low-power bulk storage solutions for unstructured data in clouds	Bulk-data applications requiring highest capacity, efficiency and enterprise-class reliability
LEARN MORE	Page 32	Page 33	Page 33	Page 34

# Choose the best drive for your enterprise or cloud storage

SEGMENT	Nearline Storage				Mission-Critical Storage		Solid State Drives	Cloud Storage Platforms
PRODUCT								
	Cloud Data Center Solutions	Enterprise Capacity 2.5 HDD	Enterprise Capacity 3.5 HDD	Terascale™ HDD	Enterprise Performance 10K HDD	Enterprise Performance 15K HDD	1200 SSD	Seagate Kinetic Open Storage platform
PERFECT FOR	Cloud Storage	High Density	Mainstream	Low Power	Mainstream	Performance	Performance	Cloud Data Center
DESCRIPTION	The highest quality of service at the lowest possible total cost of ownership (TCO)	Online reference data demands requiring cost-effective, low-power, enterprise-class drives	Bulk-data applications requiring highest capacity storage, efficiency and enterprise-class reliability	Cost-effective, low-power bulk storage solutions for unstructured data in clouds	Mainstream data requiring high capacity, performance density and reliability	Compute-intensive data requirements demanding the highest performance density and availability	Enterprise storage environments requiring high-performance SSD with data integrity and drive endurance	A software-defined, object-oriented, scale-out approach to data center architecture
LEARN MORE	Page 37	Page 37	Page 38	Page 39	Page 40	Page 41	Page 42	Page 43



# Laptop and Mobile Storage Solutions

Seagate external storage solutions are sleek, dependable and ultra-portable products that let your customers automatically and continuously store digital family photos, protect critical business data, back up multiple computers on a small network, or share and store videos and music.

Seagate laptop and tablet drives address every mobile market need, delivering superior performance, reliability and value. Feature-rich with innovative options, the Seagate mobile lineup also includes self-encryption and FIPS 140-2 validated models.



## Backup Plus Slim Portable

The Backup Plus Slim portable drive is the simple way to protect and share your entire digital life.

### Key Advantages

- Thinnest 2TB portable drive available, up to 42% thinner
- Easy, flexible backups
- Backup photos and videos from smart phones and tablets
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- USB 3.0 for speed and comparability

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Mobile device backup
- Download and save content that's posted on your social networks.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
2TB	STDR2000100	USB 3.0	● Black	PC, Mac
2TB	STDR2000101	USB 3.0	⦿ Silver	PC, Mac
2TB	STDR2000102	USB 3.0	● Blue	PC, Mac
2TB	STDR2000103	USB 3.0	● Red	PC, Mac
1TB	STDR1000100	USB 3.0	● Black	PC, Mac
1TB	STDR1000101	USB 3.0	⦿ Silver	PC, Mac
1TB	STDR1000102	USB 3.0	● Blue	PC, Mac
1TB	STDR1000103	USB 3.0	● Red	PC, Mac
500GB	STCD500102	USB 3.0	● Black	PC, Mac
500GB	STCD500104	USB 3.0	⦿ Silver	PC, Mac
PRODUCT DIMENSIONS (1TB, 2TB)	4.47-in L x 2.99-in W x 0.48-in D (113.5mm x 76mm x 12.1mm)			
PRODUCT DIMENSIONS (500GB)	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
PACKAGE DIMENSIONS	5.71-in L x 4.11-in W x 1.28-in D (145mm x 104.5mm x 32.5mm)			

## Backup Plus Slim Portable for Mac

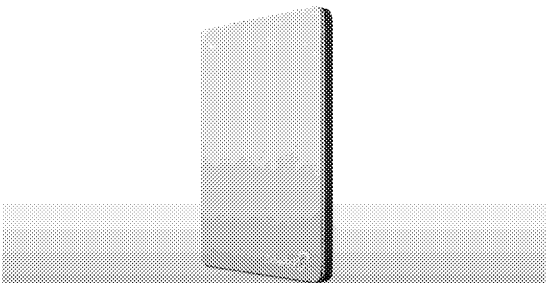
The Backup Plus Slim portable drive for Mac is the simple way to protect and share your entire digital life.

### Key Advantages

- Mac OS and Time-Machine ready out of the box
- Back up photos and videos from smart phones and tablets.
- Automatically saves photos from social networks
- USB 3.0 for speed and comparability

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Mobile device backup
- Download and save content that's posted on your social networks.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STDS1000100	USB 3.0	⦿ Silver/ ● Black	Mac, PC
500GB	STCF500102	USB 3.0	⦿ Silver/ ● Black	Mac, PC
PRODUCT DIMENSIONS (1TB)	4.47-in L x 2.99-in W x 0.48-in D (113.5mm x 76mm x 12.1mm)			
PRODUCT DIMENSIONS (500GB)	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
PACKAGE DIMENSIONS	5.71-in L x 4.11-in W x 1.28-in D (145mm x 104.5mm x 32.5mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.





# Backup Plus Fast Portable

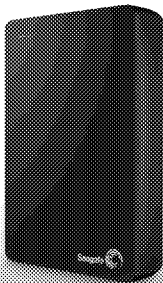
The Backup Plus Fast portable drive has up to 2x the capacity and performance of other portable drives.

### Key Advantages

- Up to 2x faster than other portable drives, up to 220MB/s
- No external power supply required
- Back up content from smart phones, tablets and computers.

### Best-Fit Applications

- Desktop capacity and performance in a portable form factor
- Carry your entire digital library with you on-the-go.
- Portable design, completely bus powered
- Mobile device backup



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STDA4000100	USB 3.0	● Black	Mac, PC
PRODUCT DIMENSIONS	4.602-in L x 3.248-in W x 0.880-in D (116.90mm x 82.50mm x 22.35mm)			
PACKAGE DIMENSIONS	5.787-in L x 5.236-in W x 1.850-in D (147mm x 133mm x 47mm)			

# Expansion Portable

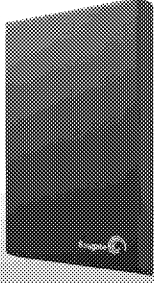
The Expansion portable drive is compact and perfect for taking large files with you on-the-go.

### Key Advantages

- Simple and straightforward setup
- Powered from the USB cable
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

### Best-Fit Applications

- Instantly add more storage space to your computer.
- Take large files with you when you travel.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
2TB	STBX2000401	USB 3.0	● Black	PC
1TB	STBX1000101	USB 3.0	● Black	PC
750GB	STBX750100	USB 3.0	● Black	PC
500GB	STBX500100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS	4.81-in L x 3.19-in W x 0.61-in D (122.3mm x 81.1mm x 15.5mm)			
PACKAGE DIMENSIONS	5.28-in L x 6.69-in W x 1.89-in D (134mm x 170mm x 48mm)			

# Backup Plus Fast SSD

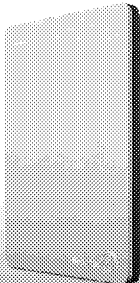
The Backup Plus Fast SSD portable drive lets you amplify genius and accelerate your creativity on the go.

### Key Advantages

- Edit your projects—even HD video—directly from the drive.
- Included USB 3.0 interface to reduce file transfer downtime and increase productivity
- Faster SSD read times and no file indexing required
- Pre-loaded backup software included—part of Seagate Dashboard

### Best-Fit Applications

- Transfer large project files at incredible speeds of up to 430MB/s.
- Keep your files on hand for collaboration.
- Fits easily into your pocket or gear—take it with you on the go.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
256GB	STCM240100	USB 3.0	● Silver	PC, Mac
PRODUCT DIMENSIONS	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
PACKAGE DIMENSIONS	5.71-in L x 4.11-in W x 1.28-in D (145mm x 104.5mm x 32.5mm)			

# Wireless Plus

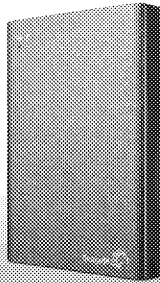
With Wireless Plus mobile device storage, you can enjoy your media and access your files without wires or Web.

### Key Advantages

- Synchronize your Dropbox and Google Drive folders to Wireless Plus
- Take your media library with you on the go
- Share media with up to eight Wi-Fi enabled devices at the same time
- Use anywhere, without an Internet connection
- Up to 10 hours battery life<sup>3</sup>

### Best-Fit Applications

- Store and carry movies and other media on the go.
- Share media with others.
- Works with IOS and Android smartphones and tablets, Amazon Kindle Fire tablets and Windows 8 PCs and tablets



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
2TB	STCV2000100	USB 3.0	● Gray	PC, Mac
1TB	STCK1000101	USB 3.0	● Gray	PC, Mac
500GB	STCV500100	USB 3.0	● Gray	PC, Mac
PRODUCT DIMENSIONS	5.00-in L x 3.50-in W x 0.8-in D (127mm x 89mm x 21mm)			
PACKAGE DIMENSIONS	6.02-in L x 2.0-in W x 7.16-in D (153mm x 51mm x 182mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.  
<sup>3</sup> Exact battery life subject to product model, normal usage conditions and configurations.



# Laptop SSHD, Laptop Thin SSHD and Ultra Mobile SSHD

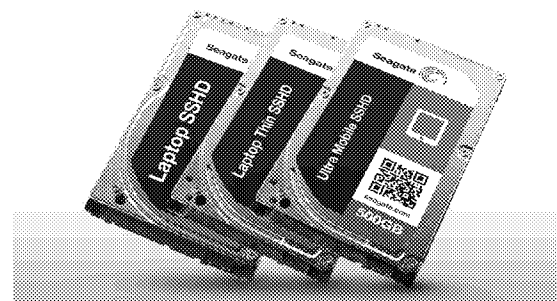
The Seagate line of Laptop and Ultra Mobile SSHD products enable PC users and gamers to enjoy SSD-like performance without sacrificing capacity.

## Key Advantages

- Boots and performs like an SSD<sup>2</sup>
- Performs up to 4x faster than a traditional HDD<sup>2</sup>
- SATA 6Gb/s with NCQ for interface speed
- All-in-one design for simplicity and ease of installation
- No special drivers needed—works in any laptop or PC, any OS and any application
- Backed by a 3-year limited warranty

## Best-Fit Applications

- Laptops, desktops, ultra books and tablets
- High-performance gaming systems
- Small form factor all-in-one PCs



CAPACITY <sup>1</sup>	MODEL	INTERFACE	HEIGHT
1TB	ST1000LM014	SATA 6Gb/s	9.5 mm
500GB	ST500LM000	SATA 6Gb/s	7 mm
500GB	ST500LX009	SATA 6Gb/s	5 mm

CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	MLC FLASH
1TB	STBD1000400	SATA 6Gb/s	8GB

PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		
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# Laptop Ultrathin HDD

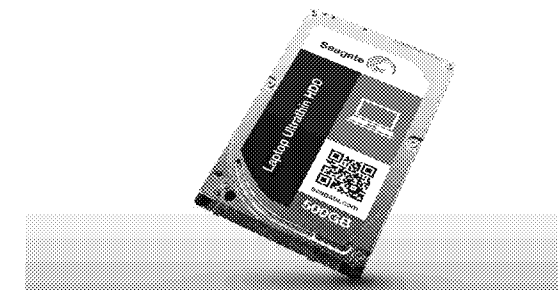
The Seagate Laptop Ultrathin HDD is one of the thinnest and lightest laptop hard drives—5mm, 3.3 oz. and thinner than a pencil.

## Key Advantages

- Affordable, high-capacity storage gives system builder options when integrating low profile storage into slim laptop and ultrabook solutions
- Compatible with every portable PC with a standard SATA 6Gb/s interface
- Get industry-leading cost-per-GB and cost-per-millimeter
- Seagate Secure™ Self-Encrypting Drive options<sup>3</sup>

## Best-Fit Applications

- Slim laptops or ultrabooks
- Extending high-capacity, affordable storage into other applications and slim devices
- Backup storage



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
500GB	ST500LT032	SATA 6Gb/s	16MB
500GB	ST500LT033 <sup>3</sup>	SATA 6Gb/s	16MB
320GB	ST320LT030	SATA 6Gb/s	16MB

# Laptop Thin HDD

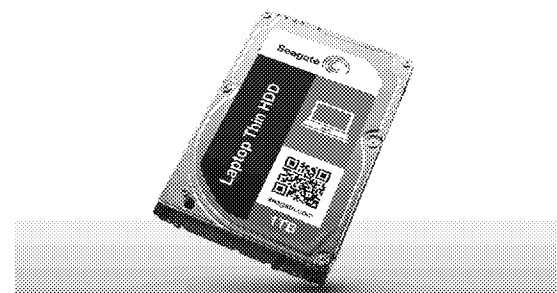
The 7mm, 2.5-inch drive enables slim computing for all types of mobile computing, from laptops to netbooks to smaller desktop PCs.

## Key Advantages

- 7mm z-height form factor enables thin chassis design for all segments of laptop computing.
- Seagate SmartAlign™ technology provides a transition to 4K sectors without the need for software utilities.
- Self-Encrypting Drive<sup>3</sup> options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification<sup>4</sup> are government-approved for the U.S. and Canadian governments.

## Best-Fit Applications

- Thin entry-level laptop PCs
- Thin high-end netbooks
- Thin ultraportables



CAPACITY <sup>1</sup>	MODEL	INTERFACE	RPM	CACHE
500GB	ST500LT025 <sup>3,5</sup>	SATA 6Gb/s	5900	16MB
500GB	ST500LT015 <sup>4,5</sup>	SATA 6Gb/s	5900	16MB
500GB	ST500LT012	SATA 6Gb/s	5900	16MB
500GB	ST500LM021	SATA 6Gb/s	7200	32MB
320GB	ST320LT012 <sup>5</sup>	SATA 6Gb/s	5900	16MB
320GB	ST320LM010	SATA 6Gb/s	7200	32MB
250GB	ST250LT012 <sup>5</sup>	SATA 6Gb/s	5900	16MB

# Ultra Mobile HDD

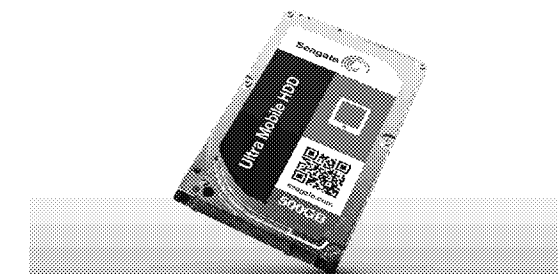
Just 5mm thin and supported by a stainless steel design, the Seagate Ultra Mobile HDD is ready for mobility.

## Key Advantages

- 500GB brings 7× more space to tablet applications at a fraction of the cost.
- Zero-gravity sensors provide extra drop protection.
- Improved shock and tolerance for gyroscopic motion supports even the intense maneuvers of gamers.
- Just 3.3 oz—about the weight of a lightbulb
- Couple with the Seagate Mobile Enablement Kit's Dynamic Data™ Driver for robust and responsive storage with no compromise to system battery life.

## Best-Fit Applications

- Tablets
- Convertible and detachable storage
- Ultra-mobile, ultra-portable storage expansion apps



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
500GB	ST500LT035	SATA 6Gb/s	16MB

# Desktop Storage Solutions

Seagate has a distinguished history in consistently delivering innovative technologies, super-sized capacities, low power and blazing-fast performance. Seagate desktop drives offer excellent performance at all levels.

## Backup Plus Desktop

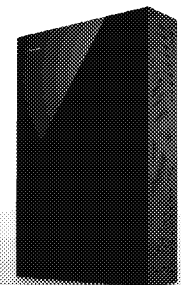
The Backup Plus desktop drive is the simple, one-click way to protect and share your entire digital life.

### Key Advantages

- Easy, flexible backups
- Back up photos and videos from smart phones and tablets.
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Up to 4TB capacity for a lifetime of memories

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Mobile device backup
- Download and save content that's posted on your social networks.



CAPACITY	KIT NUMBER <sup>1</sup>	INTERFACE	COLOR	OS
5TB	STDT5000100	USB 3.0	● Black	PC, Mac
4TB	STDT4000100	USB 3.0	● Black	PC, Mac
3TB	STDT3000101	USB 3.0	● Black	PC, Mac
2TB	STDT2000100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	7.063-in L x 4.650-in W x 1.634-in D (179.4mm x 118.10mm x 41.50mm)			
PACKAGE DIMENSIONS	8.346-in L x 8.583-in W x 2.677-in D (212mm x 218mm x 68mm)			

## Backup Plus Desktop for Mac

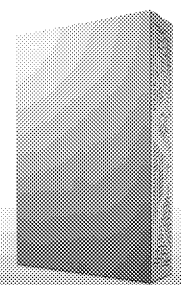
The Backup Plus desktop drive for Mac is the simple, one-click way to protect and share your entire digital life.

### Key Advantages

- Back up photos and videos from smartphones and tablets
- Mac OS and Time Machine ready right out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click.

### Best-Fit Applications

- Mobile device backup
- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY	KIT NUMBER <sup>1</sup>	INTERFACE	COLOR	OS
4TB	STDU4000100	USB 3.0	● Silver	PC, Mac
3TB	STDU3000101	USB 3.0	● Silver	PC, Mac
2TB	STDU2000100	USB 3.0	● Silver	PC, Mac
PRODUCT DIMENSIONS	7.063-in L x 4.650-in W x 1.634-in D (179.4mm x 118.10mm x 41.5mm)			
PACKAGE DIMENSIONS	8.346-in L x 8.583-in W x 2.677-in D (212mm x 218mm x 68mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.



## Expansion Desktop

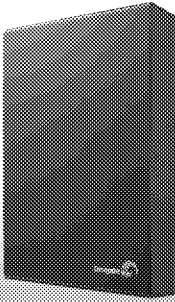
The Expansion desktop drive provides extra storage for your ever-growing collection of files.

### Key Advantages

- Simple and straightforward setup
- No software to install and nothing to configure
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

### Best-Fit Applications

- Instantly add more storage space to your computer.
- Improve performance on your computer's internal drive by freeing up space on your internal drive.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
5TB	STBV5000100	USB 3.0	● Black	PC
4TB	STBV4000100	USB 3.0	● Black	PC
3TB	STBV3000100	USB 3.0	● Black	PC
2TB	STBV2000100	USB 3.0	● Black	PC
1TB	STBV1000100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS	7.07-in L x 4.65-in W x 1.48-in D (179.5mm x 118mm x 37.5mm)			
PACKAGE DIMENSIONS	9.09-in L x 7.95-in W x 2.83-in D (231mm x 202mm x 72mm)			

## Desktop SSHD

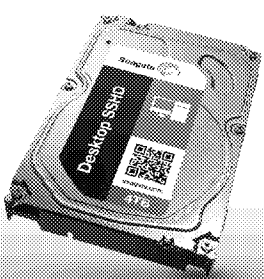
Seagate Desktop SSHD (solid state hybrid drive) delivers SSD-like performance and massive capacities at an affordable price.

### Key Advantages

- First SSHD in a 3.5-inch form factor
- SATA 6Gb/s with NCQ for interface speed
- Performs up to 3× faster than a traditional HDD<sup>3</sup>
- All-in-one design for ease of installation
- Installs and operates like a standard hard drive
- Massive 1TB, 2TB or 4TB capacities combined with SSD-like performance<sup>3</sup>

### Best-Fit Applications

- Desktop PCs
- Workstations
- High-performance direct-attached storage (DAS) devices



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000DX001	SATA 6Gb/s	64MB
2TB	ST2000DX001	SATA 6Gb/s	64MB
1TB	ST1000DX001	SATA 6Gb/s	64MB

CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	MLC FLASH
4TB	STCL4000400	SATA 6Gb/s	8GB
2TB	STCL2000400	SATA 6Gb/s	8GB
PACKAGE DIMENSIONS	5.88-in L x 7.75-in W x 2.88-in D (149.35mm x 196.85mm x 73.15mm)		

## Desktop HDD

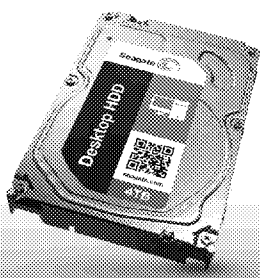
Seagate Desktop HDDs give you the Power of One with 1TB-per-disk technology and one drive platform for every desktop capacity and application.

### Key Advantages

- Up to 4TB capacity
- AcuTrac™ technology deliver dependable overall performance.
- Free Seagate DiscWizard™ software

### Best-Fit Applications

- Desktop systems
- All-in-one PCs
- Entry-level home servers



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000DM000	SATA 6Gb/s NCQ	64MB
3TB	ST3000DM001	SATA 6Gb/s NCQ	64MB
2TB	ST2000DM001	SATA 6Gb/s NCQ	64MB
1TB	ST1000DM003	SATA 6Gb/s NCQ	64MB
500GB	ST500DM002	SATA 6Gb/s NCQ	16MB
320GB	ST320DM000	SATA 6Gb/s NCQ	16MB
250GB	ST250DM000	SATA 6Gb/s NCQ	16MB

CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	CACHE
4TB	STBD4000400	SATA 6Gb/s	64MB
3TB	STBD3000100	SATA 6Gb/s	64MB
2TB	STBD2000101	SATA 6Gb/s	64MB
1TB	ST310005N1A1AS-RK	SATA 6Gb/s	64MB
PACKAGE DIMENSIONS	5.88-in L x 7.75-in W x 2.88-in D (149.35mm x 196.85mm x 73.15mm)		

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.  
<sup>3</sup> Performance may vary depending on user's hardware configuration and operating system.



# DVR and Video Storage Solutions

Storage solutions for digital video recorders (DVR) and video applications

Seagate continues its recognized leadership and reliability in the DVR space to deliver first-class video-optimized products. From media centers and set-top boxes to DVR storage and expansion, Seagate has a solution, no matter what your video need.

## Wireless Plus

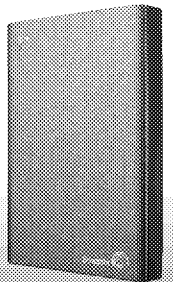
With Wireless Plus mobile device storage, you can enjoy your media and access your files without wires or Web.

### Key Advantages

- Synchronize your Dropbox and Google Drive folders to Wireless Plus
- Take your media library with you on the go
- Share media with up to eight Wi-Fi enabled devices at the same time
- Use anywhere, without an Internet connection
- Up to 10 hours battery life<sup>3</sup>

### Best-Fit Applications

- Store and carry movies and other media on the go.
- Share media with others.
- Works with IOS and Android smartphones and tablets, Amazon Kindle Fire tablets and Windows 8 PCs and tablets



CAPACITY	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
2TB	STCV2000100	USB 3.0	Gray	PC, Mac
1TB	STCK1000101	USB 3.0	Gray	PC, Mac
500GB	STCV500100	USB 3.0	Gray	PC, Mac
PRODUCT DIMENSIONS	5.00-in L x 3.50-in W x 0.8-in D (127mm x 89mm x 21mm)			
PACKAGE DIMENSIONS	6.02-in L x 2.0-in W x 7.16-in D (153mm x 51mm x 182mm)			

## Central

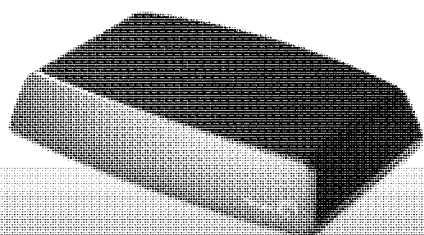
The Central shared network storage system allows you to create secure in-home cloud storage for multiple computers in the home.

### Key Advantages

- Automatically back up multiple PC and Mac computers
- Wirelessly stream your centralized media library to gaming consoles, media players and smart TVs
- Access content on-the-go with a Web browser or the free app for tablets and smartphones

### Best-Fit Applications

- Consolidate content on one easily accessible device
- Back up multiple PC and Mac computers
- Enjoy a centralized media library on smart TVs, game consoles and media players
- Access your content on-the-go with laptops and mobile devices
- Archive your Facebook photos and videos



CAPACITY	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STCG4000100	SATA/GigE	Black	PC, Mac
3TB	STCG3000100	SATA/GigE	Black	PC, Mac
2TB	STCG2000100	SATA/GigE	Black	PC, Mac
PRODUCT DIMENSIONS	5.7-in L x 8.5-in W x 1.7-in D (145mm x 216mm x 42mm)			
PACKAGE DIMENSIONS	3.15-in L x 10.3-in W x 9.25-in D (80mm x 261mm x 235mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.  
<sup>3</sup> Exact battery life subject to product model, normal usage conditions and configurations.



## DVR Expander

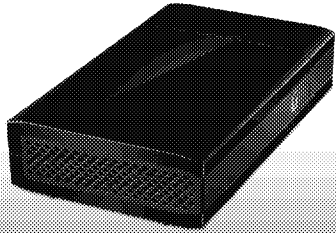
This simple add-on storage for your DVR lets you save more of your favorite HDTV shows and movies.

### Key Advantages

- Instantly add more recording hours for your favorite shows.
- Capture extended-length movies, sporting events, and archive seasons of your favorite TV shows.
- Can stand vertically or lie flat
- Includes both USB 2.0 and eSATA connections

### Best-Fit Applications

- Expand your DVR storage capacity.
- Build your library without having to delete older shows.
- Low-profile design fits neatly into your home entertainment environment



CAPACITY <sup>1</sup>	KIT NUMBER	INTERFACE	COLOR	OS
2TB	STAP2000102	USB 2.0/eSATA	● Black	PC, Mac
1TB	STAP1000103	USB 2.0/eSATA	● Black	PC, Mac
PRODUCT DIMENSIONS	8-in L x 4.73-in W x 1.81-in D (203mm x 120mm x 46mm)			
PACKAGE DIMENSIONS	8.67-in L x 3.07-in W x 9.33-in D (222mm x 78mm x 237mm)			

## Video 3.5 HDD

Seagate Video 3.5 HDDs deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

### Key Advantages

- Quiet drive operation to enhance customer viewing and listening experiences
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

### Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000VM000	SATA 6Gb/s	64MB
3TB	ST3000VM002	SATA 6Gb/s	64MB
2TB	ST2000VM003	SATA 6Gb/s	64MB
1TB	ST1000VM002	SATA 6Gb/s	64MB
500GB	ST3500312CS	SATA 3Gb/s	8MB
320GB	ST3320311CS	SATA 3Gb/s	8MB
250GB	ST3250312CS	SATA 3Gb/s	8MB

## Video 2.5 HDD


Seagate Video 2.5 HDDs let you stream, record and play back your video content with unparalleled reliability and performance.

### Key Advantages

- Virtually silent streaming performance as low as 19dB
- Built for 24x7 operation and low power consumption
- Small, 2.5-inch form factor allows system cost reduction and operational power savings
- Fanless design allows flexibility in a sleek system design.
- 0.55% AFR supports longevity in demanding consumer electronic environments.

### Best-Fit Applications

- DVR and media center applications
- Home theater PCs
- Karaoke and audio jukeboxes
- Cable, satellite and IPTV set-top boxes
- In-camera or surveillance systems



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
500GB	ST500VT000	SATA 3Gb/s	16MB
320GB	ST320VT000	SATA 3Gb/s	16MB
250GB	ST250VT000	SATA 3Gb/s	16MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown

# Surveillance Storage Solutions

A pioneer in the surveillance space, Seagate leads the market with purpose-built surveillance storage. From entry-level surveillance DVRs to the rapidly growing network video recorder (NVR) and centralized surveillance storage, Seagate has a solution to meet your needs.

## Surveillance HDD

The Seagate Surveillance HDD (formerly SV35 Series) is purpose-built surveillance storage that can keep your systems in the field longer and reduce post-deployment support.

### Key Advantages

- Seventh-generation surveillance-optimized drive improves video streaming and data integrity in surveillance applications
- Support for up to 32 cameras per drive and 16 drives in a system
- Reliably performs in multi-drive systems with RAID support from RV sensors

### Best-Fit Applications

- Network Video Recorder (NVR)
- Embedded SDVR
- Hybrid SDVR
- Surveillance DVR



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000VX000	SATA 6Gb/s	64MB
3TB	ST3000VX002	SATA 6Gb/s	64MB
3TB	ST3000VX000	SATA 6Gb/s	64MB
2TB	ST2000VX000	SATA 6Gb/s	64MB
1TB	ST1000VX000	SATA 6Gb/s	64MB



<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.



## Enterprise Capacity 3.5 HDD

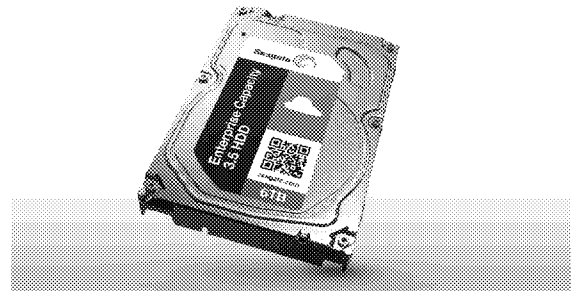
The Seagate Enterprise Capacity 3.5 HDDs help centralized or cloud surveillance systems and systems leveraging high levels of video analytics.

### Key Advantages

- Highest-capacity enterprise drive for maximum density server and storage solutions
- SAS and SATA interfaces with 24x7 reliability
- Predictable performance even in the most rugged multi-drive environments
- Improved power and cooling efficiencies with low power consumption and on-demand PowerChoice™ technology
- Protect your data and ease data disposal costs and management with the Self-Encrypting Drive (SED) and FIPS 140-2 certified SED<sup>2,3</sup>

### Best-Fit Applications

- Massive scale-out surveillance environments
- High-density data centers
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore
- Centralized surveillance



CAPACITY	MODEL NUMBER	SECTOR SIZE	INTERFACE	CACHE
6TB	ST6000NM0004	4KN	SATA 6Gb/s	128MB
6TB	ST6000NM0024	5xxE	SATA 6Gb/s	128MB
6TB	ST6000NM0044 <sup>2</sup>	5xxE	SATA 6Gb/s	128MB
6TB	ST6000NM0084 <sup>2,3</sup>	5xxE	SATA 6Gb/s	128MB
6TB	ST6000NM0014	5xxE	12Gb/s SAS	128MB
6TB	ST6000NM0034	5xxE	12Gb/s SAS	128MB
6TB	ST6000NM0054 <sup>2</sup>	5xxE	12Gb/s SAS	128MB
6TB	ST6000NM0104 <sup>2,3</sup>	5xxE	12Gb/s SAS	128MB
6TB	ST5000NM0024	5xxE	SATA 6Gb/s	128MB
4TB	ST4000NM0024	5xxE	SATA 6Gb/s	128MB
4TB	ST4000NM0044 <sup>2</sup>	5xxE	SATA 6Gb/s	128MB
4TB	ST4000NM0034	5xxE	12Gb/s SAS	128MB
4TB	ST4000NM0054 <sup>2</sup>	5xxE	12Gb/s SAS	128MB
4TB	ST4000NM0033	5xxN	SATA 6Gb/s	128MB
4TB	ST4000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
4TB	ST4000NM0073 <sup>2,3</sup>	5xxN	SATA 6Gb/s	128MB
4TB	ST4000NM0023	5xxN	6Gb/s SAS	128MB
4TB	ST4000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
4TB	ST4000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB
3TB	ST3000NM0033	5xxN	SATA 6Gb/s	128MB
3TB	ST3000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
3TB	ST3000NM0023	5xxN	6Gb/s SAS	128MB
3TB	ST3000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
3TB	ST3000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB
2TB	ST2000NM0024	5xxE	SATA 6Gb/s	128MB
2TB	ST2000NM0044 <sup>2</sup>	5xxE	SATA 6Gb/s	128MB
2TB	ST2000NM0034	5xxE	12Gb/s SAS	128MB
2TB	ST2000NM0054 <sup>2</sup>	5xxE	12Gb/s SAS	128MB
2TB	ST2000NM0033	5xxN	SATA 6Gb/s	128MB
2TB	ST2000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
2TB	ST2000NM0023	5xxN	6Gb/s SAS	128MB
2TB	ST2000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
2TB	ST2000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB
1TB	ST1000NM0033	5xxN	SATA 6Gb/s	128MB
1TB	ST1000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
1TB	ST1000NM0023	5xxN	6Gb/s SAS	128MB
1TB	ST1000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
1TB	ST1000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB

## Video 3.5 HDD

Seagate Video 3.5 HDDs deliver unprecedented levels of acoustic, power and vibration performance with room for months of surveillance footage.

### Key Advantages

- Quiet drive operation to enhance customer viewing and listening experiences
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

### Best-Fit Applications

- Surveillance digital video recorders
- Media servers and centers



CAPACITY	MODEL	INTERFACE	CACHE
4TB	ST4000VM000	SATA 6Gb/s	64MB
3TB	ST3000VM002	SATA 6Gb/s	64MB
2TB	ST2000VM003	SATA 6Gb/s	64MB
1TB	ST1000VM002	SATA 6Gb/s	64MB
500GB	ST3500312CS	SATA 3Gb/s	8MB
320GB	ST3320311CS	SATA 3Gb/s	8MB
250GB	ST3250312CS	SATA 3Gb/s	8MB

## Video 2.5 HDD

Seagate Video 2.5 HDDs let you stream, record and play back your video content with unparalleled reliability and performance.

### Key Advantages

- Virtually silent streaming performance as low as 19dB
- Built for 24x7 operation and low power consumption
- Small, 2.5-inch form factor allows system cost reduction and operational power savings
- Fanless design allows flexibility in a sleek system design.
- 0.55% AFR supports longevity in demanding consumer electronic environments.

### Best-Fit Applications

- Entry-level surveillance DVR
- Home surveillance PCs



CAPACITY	MODEL	INTERFACE	CACHE
500GB	ST500VT000	SATA 3Gb/s	16MB
320GB	ST320VT000	SATA 3Gb/s	16MB
250GB	ST250VT000	SATA 3Gb/s	16MB

# Network-Attached Storage Solutions

Seagate network-attached storage (NAS) solutions meet the ever-changing needs of business. Exploding volumes of business data. Increasingly decentralized operations. An expanding mobile workforce. Whatever your challenge, the Seagate family of NAS products has the flexible capacity, unparalleled performance and best-in-class security you need to take your business to the next level.

## Business Storage 8-Bay Rackmount NAS

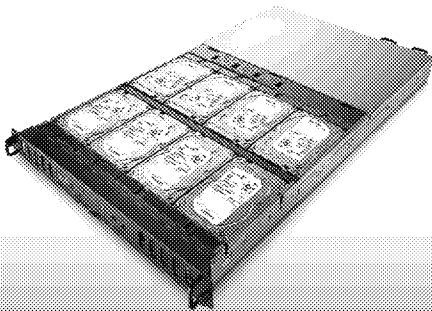
A complete network storage solution with innovative 8-bay design in a 1U form factor that is perfect for growing businesses

### Key Advantages

- A 2.3GHz dual-core Intel processor delivers file transfer performance of up to 200MB/s
- Wuala™ cloud service and apps for secure collaboration and anywhere access
- Centralized backup for PCs, plus Time Machine support for Mac computers
- Support for iSCSI enables maximum performance and compatibility for virtualized environments

### Best-Fit Applications

- Store business-critical files centrally and securely
- Back up your organization's PC and Mac computers
- Access and manage files remotely using Internet-connected computers and devices
- Back up files to the cloud



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
32TB	STDP32000100	Gigabit Ethernet	● Black	PC, Mac
24TB	STDP24000100	Gigabit Ethernet	● Black	PC, Mac
18TB	STDP18000100	Gigabit Ethernet	● Black	PC, Mac
12TB	STDP12000100	Gigabit Ethernet	● Black	PC, Mac
8TB	STDP8000100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	30.394-in L x 1.713-in W x 18.78-in D (772mm x 43.5mm x 477mm)			
PACKAGE DIMENSIONS	35.354-in L x 23.465-in W x 8.661-in D (898mm x 596mm x 220mm)			

## Business Storage 4-Bay Rackmount NAS

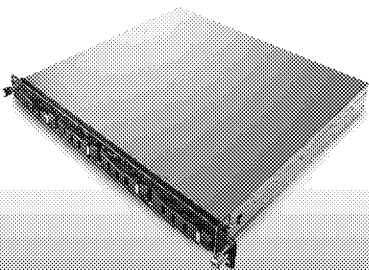
Centralize your storage and backups with a complete network storage solution that saves valuable floor space for small businesses.

### Key Advantages

- Centralized storage and backup for PCs and Macs, plus secure Wuala cloud off-site backup service
- A dual-core Intel Atom processor and new, performance-optimized Seagate NAS OS deliver file transfer speeds up to 200MB/s
- Anywhere access to your files
- Hot-swappable drives and dual Gigabit Ethernet ports help increase up-time

### Best-Fit Applications

- Store business-critical files centrally and securely
- Back up your organization's PC and Mac computers
- Access and manage files remotely using Internet-connected computers and devices
- Back up files to the cloud



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
16TB	STDN16000100	Gigabit Ethernet	● Black	PC, Mac
12TB	STDN12000100	Gigabit Ethernet	● Black	PC, Mac
8TB	STDN8000100	Gigabit Ethernet	● Black	PC, Mac
4TB	STDN4000100	Gigabit Ethernet	● Black	PC, Mac
....	STDN100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	16.929-in L x 15-in W x 1.713-in D (430mm x 381mm x 42.5mm)			
PACKAGE DIMENSIONS	22.44-in L x 19.567-in W x 6.496-in D (570mm x 497mm x 164mm)			

1 One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
2 U.S. model numbers shown





# Business Storage 4-Bay NAS

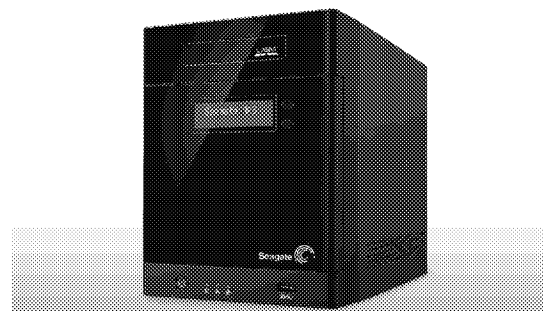
A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations

## Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0, 1, 5 and 10 configuration options

## Best-Fit Applications

- Make automatic, continuous backups
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected devices
- Create cost-effective, private cloud storage
- Encrypt individual files to entire volumes of data



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
16TB	STBP16000100	Gigabit Ethernet	● Black	PC, Mac
12TB	STBP12000100	Gigabit Ethernet	● Black	PC, Mac
8TB	STBP8000100	Gigabit Ethernet	● Black	PC, Mac
4TB	STBP4000100	Gigabit Ethernet	● Black	PC, Mac
---	STBP100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	6.3-in W x 8.2-in H x 10.2-in D (161.00mm x 208.00mm x 258.50mm)			
PACKAGE DIMENSIONS	9.4-in W x 14.9-in H x 9.4-in D (240.00mm x 379.00mm x 243.00mm)			

# Business Storage 2-Bay NAS


Create a private cloud to help protect your business-critical data and centralize files in a single location you can access from anywhere

## Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0 and 1 configuration options

## Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
8TB	STBN8000100	Gigabit Ethernet	● Black	PC, Mac
6TB	STBN6000100	Gigabit Ethernet	● Black	PC, Mac
4TB	STBN4000100	Gigabit Ethernet	● Black	PC, Mac
---	STBN100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	4.1-in W x 8.0-in H x 8.9-in D (104.50mm x 204.00mm x 227.00mm)			
PACKAGE DIMENSIONS	6.2-in W x 10.9-in H x 12.5-in D (157.00mm x 277.00mm x 317.00mm)			

# Business Storage Windows Server 4-Bay NAS


Expand into a branch office or add local storage to your network by utilizing your existing Windows IT infrastructure.

## Key Advantages

- Complete integration with your existing Windows IT infrastructure
- Native support for Active Directory lets you simplify setup and manage users through an existing directory.
- Delivers network file transfer performance up to 200MB/s
- Connect external drives to USB 3.0 ports or USM slot.

## Best-Fit Applications

- Branch offices with up to 50 employees
- Growing businesses utilizing Windows IT infrastructure
- Centralize management and integration with other Windows Servers



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
16TB	STDM16000100	Gigabit Ethernet	● Black	PC, Mac
12TB	STDM12000100	Gigabit Ethernet	● Black	PC, Mac
8TB	STDM8000100	Gigabit Ethernet	● Black	PC, Mac
4TB	STDM4000100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	9.921-in L x 6.299-in W x 7.874-in D (252mm x 160mm x 200mm)			
PACKAGE DIMENSIONS	15.197-in L x 9.409-in W x 9.488-in D (386mm x 239mm x 241mm)			

# Business Storage 1-Bay NAS


Create a private cloud with Seagate Business Storage 1-Bay NAS. It helps protect your all-important data and centralizes your files in a single location you can access from anywhere.

## Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Stream your media library to networked computers, Internet TVs, game consoles and more

## Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STBM4000100	Gigabit Ethernet	● Black	PC, Mac
3TB	STBM3000100	Gigabit Ethernet	● Black	PC, Mac
2TB	STBM2000100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	2.4-in W x 6.9-in H x 5.8-in D (61mm x 176mm x 148mm)			
PACKAGE DIMENSIONS	3.7-in W x 9.3-in H x 9.0-in D (93mm x 236mm x 229mm)			





# Central

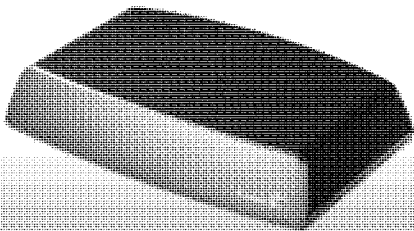
The Central shared network storage system allows you to create secure in-home cloud storage for multiple computers in the home.

## Key Advantages

- Automatically back up multiple PC and Mac computers
- Wirelessly stream your centralized media library to gaming consoles, media players and smart TVs
- Access content on-the-go with a Web browser or the free app for tablets and smartphones

## Best-Fit Applications

- Consolidate content on one easily accessible device
- Back up multiple PC and Mac computers
- Enjoy a centralized media library on smart TVs, game consoles and media players
- Access your content on-the-go with laptops and mobile devices
- Archive your Facebook photos and videos



CAPACITY	MODEL	INTERFACE	COLOR	OS
4TB	STCG4000100	SATA/GigE	Black	PC, Mac
3TB	STCG3000100	SATA/GigE	Black	PC, Mac
2TB	STCG2000100	SATA/GigE	Black	PC, Mac
PRODUCT DIMENSIONS	5.7-in L x 8.5-in W x 1.7-in D (145mm x 216mm x 42mm)			
PACKAGE DIMENSIONS	3.15-in L x 10.3-in W x 9.25-in D (80mm x 261mm x 235mm)			

# NAS HDD

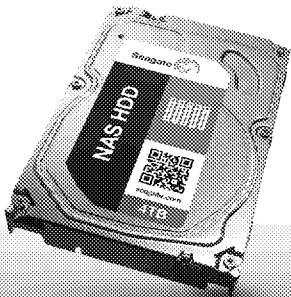
The Seagate NAS HDD fine-tunes the needs of 1- to 5-bay NAS systems to provide industry-leading performance and highest-capacity storage.

## Key Advantages

- NASWorks™ technology supports custom error recovery controls, power management and vibration tolerance.
- NAS error recovery controls help to ensure drives are not dropped from the NAS and sent into a RAID rebuild.
- Improved vibration tolerance and emission in multi-drive systems with dual-plane balance
- Advanced power management supports multiple power profiles for low-power, 24x7 performance.

## Best-Fit Applications

- Home servers or desktop NAS solutions
- Small-business file sharing
- Backup servers



CAPACITY	MODEL	INTERFACE	CACHE
4TB	ST4000VN000	SATA 6Gb/s	64MB
3TB	ST3000VN000	SATA 6Gb/s	64MB
2TB	ST2000VN000	SATA 6Gb/s	64MB

# Terascale™ HDD

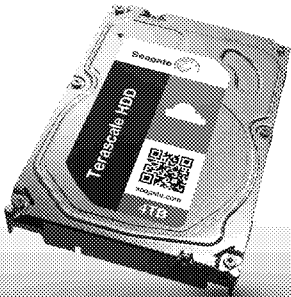
The Seagate Terascale HDD is designed for large Web-scale data centers where low-cost, low-power and high-capacity storage is critical.

## Key Advantages

- Affordable storage for 24x7 multi-drive replicated environments
- High vibration tolerance for reliable enterprise-class performance
- Low power and cooling costs with the lowest 3.5-inch enterprise drive operating power
- Advanced format logical block management for industry-leading data integrity

## Best-Fit Applications

- Web-scale computing
- Cloud storage servers and arrays
- Cloud backup storage
- Direct-attached external storage (DAS)
- Network-attached storage (NAS)



CAPACITY	5x EMULATION	MODEL	INTERFACE	CACHE
4TB		ST4000NC000 <sup>1</sup>	SATA 6Gb/s	64MB
4TB		ST4000NC001	SATA 6Gb/s	64MB
3TB		ST3000NC002	SATA 6Gb/s	64MB
3TB		ST3000NC000 <sup>1</sup>	SATA 6Gb/s	64MB
2TB		ST2000NC001	SATA 6Gb/s	64MB
2TB		ST2000NC000 <sup>1</sup>	SATA 6Gb/s	64MB
1TB		ST1000NC001	SATA 6Gb/s	64MB
1TB		ST1000NC000 <sup>1</sup>	SATA 6Gb/s	64MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.  
<sup>3</sup> Seagate Instant Secure Erase Model.





## Enterprise Capacity 3.5 HDD

The Seagate Enterprise Capacity 3.5 HDDs help both private and public data centers meet the demanding growth of unstructured data in high-density NAS environments.

### Key Advantages

- Highest-capacity enterprise drive for maximum density server and storage solutions
- SAS and SATA interfaces with 24x7 reliability
- Predictable 7200-RPM performance even in the most rugged multi-drive environments
- Improved power and cooling efficiencies with low power consumption and on-demand PowerChoice™ technology
- Protect your data and ease data disposal costs and management with the Self-Encrypting Drive (SED) and FIPS 140-2 certified SED<sup>2,3</sup>

### Best-Fit Applications

- Massive scale-out NAS environments
- High-density NAS solutions
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore—D2D, virtual tape



CAPACITY	MODEL NUMBER	SECTOR SIZE	INTERFACE	CACHE
6TB	ST6000NM0004	4KN	SATA 6Gb/s	128MB
6TB	ST6000NM0024	5xxE	SATA 6Gb/s	128MB
6TB	ST6000NM0044 <sup>2</sup>	5xxE	SATA 6Gb/s	128MB
6TB	ST6000NM0084 <sup>2,3</sup>	5xxE	SATA 6Gb/s	128MB
6TB	ST6000NM0014	5xxE	12Gb/s SAS	128MB
6TB	ST6000NM0034	5xxE	12Gb/s SAS	128MB
6TB	ST6000NM0054 <sup>2</sup>	5xxE	12Gb/s SAS	128MB
6TB	ST6000NM0104 <sup>2,3</sup>	5xxE	12Gb/s SAS	128MB
5TB	ST5000NM0024	5xxE	SATA 6Gb/s	128MB
4TB	ST4000NM0024	5xxE	SATA 6Gb/s	128MB
4TB	ST4000NM0044 <sup>2</sup>	5xxE	SATA 6Gb/s	128MB
4TB	ST4000NM0034	5xxE	12Gb/s SAS	128MB
4TB	ST4000NM0054 <sup>2</sup>	5xxE	12Gb/s SAS	128MB
4TB	ST4000NM0033	5xxN	SATA 6Gb/s	128MB
4TB	ST4000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
4TB	ST4000NM0073 <sup>2,3</sup>	5xxN	SATA 6Gb/s	128MB
4TB	ST4000NM0023	5xxN	6Gb/s SAS	128MB
4TB	ST4000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
4TB	ST4000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB
3TB	ST3000NM0033	5xxN	SATA 6Gb/s	128MB
3TB	ST3000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
3TB	ST3000NM0023	5xxN	6Gb/s SAS	128MB
3TB	ST3000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
3TB	ST3000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB
2TB	ST2000NM0024	5xxE	SATA 6Gb/s	128MB
2TB	ST2000NM0044 <sup>2</sup>	5xxE	SATA 6Gb/s	128MB
2TB	ST2000NM0034	5xxE	12Gb/s SAS	128MB
2TB	ST2000NM0054 <sup>2</sup>	5xxE	12Gb/s SAS	128MB
2TB	ST2000NM0033	5xxN	SATA 6Gb/s	128MB
2TB	ST2000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
2TB	ST2000NM0023	5xxN	6Gb/s SAS	128MB
2TB	ST2000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
2TB	ST2000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB
1TB	ST1000NM0033	5xxN	SATA 6Gb/s	128MB
1TB	ST1000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
1TB	ST1000NM0023	5xxN	6Gb/s SAS	128MB
1TB	ST1000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
1TB	ST1000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB



<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive (SED) and FIPS 140-2 Validated drives are not available in all models or countries.  
 May require TEG compliance tool or controller support.  
<sup>3</sup> FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificate at <http://www.nist.gov/groups/STM/cryptdev/documents/140-1/1401vrs2011.htm#fig35>

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# Enterprise and Cloud Storage Solutions

With more than 30 years of experience and the broadest storage product portfolio available, Seagate consistently designs, builds and supports industry-leading enterprise hard drives, solid state drives and hybrid drives. Seagate has the global presence, processes and resources to support businesses of all sizes with the highest-quality enterprise storage products.

## Cloud Data Center Solutions

As the need for data storage continues to explode, enterprise and cloud architects and data center managers are challenged to deliver the highest quality of service at the lowest possible total cost of ownership (TCO). Seagate can help.

### Choose the Right Enterprise Drives for Your Data Center Applications

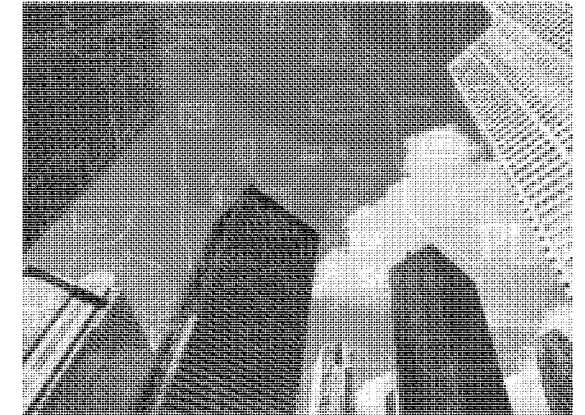
Navigating storage technology tradeoffs from capacity to performance, deploy-ability to manageability, and predictability to reliability can be complex. Seagate enables you to choose the storage technology that best meets your needs today and as your business grows.

### Data Center Management and Operational Efficiency

The costs of designing, deploying, operating and supporting data centers continue to rise. Seagate services, features and platforms enable you to increase operational efficiency by driving unneeded cost out of the data center.

### Seagate Kinetic Open Storage Platform

The Seagate Kinetic Open Storage platform is the first device-based storage platform enabling independent software vendors (ISV), cloud service providers (CSP) and enterprise customers to optimize scale-out file and object-based storage, delivering lower TCO.



## Enterprise Capacity 2.5 HDD

The Seagate Enterprise Capacity 2.5 HDD drive is the only 2.5-inch enterprise-class hard drive delivering both 1TB capacities and enterprise reliability.

### Key Advantages

- Maximizes data center footprint
- Energy-efficient storage at under 3.9W (idle)
- Highest nearline reliability with an MTBF of 1.4M hours
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data.
- FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Storage-hungry business applications
- Storage area networks and network-attached storage
- Maximum-capacity servers and blade servers
- Rich media content storage
- Enterprise backup and restore—D2D, virtual tape
- Cloud computing

1 One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
2 Self-Encrypting Drive (SED) and FIPS 140-2 Validated drives are not available in all models or countries. May require TCO-compliant host or controller support.  
3 See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/corp/documents/140-1/1401vsg2011.html>.  
4 FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/corp/documents/140-1/1401vsg2011.html#1R35>.



CAPACITY	5-yr. NATIVE MODEL	INTERFACE	CACHE
1TB	ST91000640NS	SATA 6Gb/s	64MB
1TB	ST91000641NS <sup>2</sup>	SATA 6Gb/s	64MB
1TB	ST91000642NS <sup>2,4</sup>	SATA 6Gb/s	64MB
1TB	ST91000640SS	6Gb/s SAS	64MB
1TB	ST91000641SS <sup>2</sup>	6Gb/s SAS	64MB
1TB	ST91000642SS <sup>2,4</sup>	6Gb/s SAS	64MB
500GB	ST9500620NS	SATA 6Gb/s	64MB
500GB	ST9500620SS	6Gb/s SAS	64MB
250GB	ST9250610NS	SATA 6Gb/s	64MB



# Enterprise Capacity 3.5 HDD

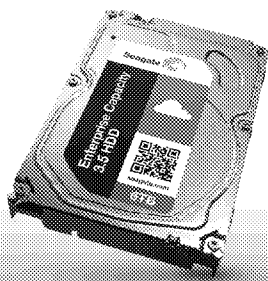
The Seagate Enterprise Capacity 3.5 HDDs help both private and public data centers meet the demanding growth of unstructured data.

### Key Advantages

- Highest-capacity enterprise drive for maximum density server and storage solutions
- SAS and SATA interfaces with 24x7 reliability
- Predictable 7200-RPM performance even in the most rugged multi-drive environments
- Improved power and cooling efficiencies with low power consumption and on-demand PowerChoice™ technology
- Protect your data and ease data disposal costs and management with the Self-Encrypting Drive (SED) and FIPS 140-2 certified SED<sup>2,3</sup>

### Best-Fit Applications

- Massive scale-out storage environments
- High-density data centers
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance
- High Density NAS Solutions



CAPACITY	MODEL NUMBER	SECTOR SIZE	INTERFACE	CACHE
6TB	ST6000NM0004	4KN	SATA 6Gb/s	128MB
6TB	ST6000NM0024	5xxE	SATA 6Gb/s	128MB
6TB	ST6000NM0044 <sup>2</sup>	5xxE	SATA 6Gb/s	128MB
6TB	ST6000NM0084 <sup>2,3</sup>	5xxE	SATA 6Gb/s	128MB
6TB	ST6000NM0014	5xxE	12Gb/s SAS	128MB
6TB	ST6000NM0034	5xxE	12Gb/s SAS	128MB
6TB	ST6000NM0054 <sup>2</sup>	5xxE	12Gb/s SAS	128MB
6TB	ST6000NM0104 <sup>2,3</sup>	5xxE	12Gb/s SAS	128MB
5TB	ST5000NM0024	5xxE	SATA 6Gb/s	128MB
4TB	ST4000NM0024	5xxE	SATA 6Gb/s	128MB
4TB	ST4000NM0044 <sup>2</sup>	5xxE	SATA 6Gb/s	128MB
4TB	ST4000NM0034	5xxE	12Gb/s SAS	128MB
4TB	ST4000NM0054 <sup>2</sup>	5xxE	12Gb/s SAS	128MB
4TB	ST4000NM0033	5xxN	SATA 6Gb/s	128MB
4TB	ST4000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
4TB	ST4000NM0073 <sup>2,3</sup>	5xxN	SATA 6Gb/s	128MB
4TB	ST4000NM0023	5xxN	6Gb/s SAS	128MB
4TB	ST4000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
4TB	ST4000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB
3TB	ST3000NM0033	5xxN	SATA 6Gb/s	128MB
3TB	ST3000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
3TB	ST3000NM0023	5xxN	6Gb/s SAS	128MB
3TB	ST3000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
3TB	ST3000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB
2TB	ST2000NM0024	5xxE	SATA 6Gb/s	128MB
2TB	ST2000NM0044 <sup>2</sup>	5xxE	SATA 6Gb/s	128MB
2TB	ST2000NM0034	5xxE	12Gb/s SAS	128MB
2TB	ST2000NM0054 <sup>2</sup>	5xxE	12Gb/s SAS	128MB
2TB	ST2000NM0033	5xxN	SATA 6Gb/s	128MB
2TB	ST2000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
2TB	ST2000NM0023	5xxN	6Gb/s SAS	128MB
2TB	ST2000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
2TB	ST2000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB
1TB	ST1000NM0033	5xxN	SATA 6Gb/s	128MB
1TB	ST1000NM0053 <sup>2</sup>	5xxN	SATA 6Gb/s	128MB
1TB	ST1000NM0023	5xxN	6Gb/s SAS	128MB
1TB	ST1000NM0043 <sup>2</sup>	5xxN	6Gb/s SAS	128MB
1TB	ST1000NM0063 <sup>2,3</sup>	5xxN	6Gb/s SAS	128MB

# Terascale™ HDD

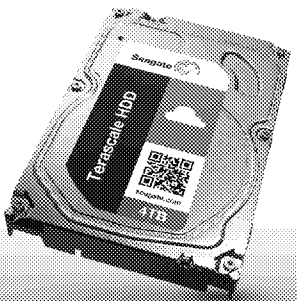
The Seagate Terascale HDD is designed for large Web-scale data centers where low-cost, low-power and high-capacity storage is critical.

### Key Advantages

- Affordable storage for 24x7 multi-drive replicated environments
- High vibration tolerance for reliable enterprise-class performance
- Low power and cooling costs with the lowest 3.5-inch enterprise drive operating power
- Advanced format logical block management for industry-leading data integrity

### Best-Fit Applications

- Web-scale computing
- Cloud storage servers and arrays
- Cloud backup storage
- Direct-attached external storage (DAS)
- Network-attached storage (NAS)



CAPACITY	5xx EMBLATION MODEL	INTERFACE	CACHE
4TB	ST4000NC000 <sup>4</sup>	SATA 6Gb/s	64MB
4TB	ST4000NC001	SATA 6Gb/s	64MB
3TB	ST3000NC002	SATA 6Gb/s	64MB
3TB	ST3000NC000 <sup>4</sup>	SATA 6Gb/s	64MB
2TB	ST2000NC001	SATA 6Gb/s	64MB
2TB	ST2000NC000 <sup>4</sup>	SATA 6Gb/s	64MB
1TB	ST1000NC001	SATA 6Gb/s	64MB
1TB	ST1000NC000 <sup>4</sup>	SATA 6Gb/s	64MB

1 One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
2 Self-Encrypting Drives (SED) and FIPS 140-2 Validated drives are not available in all models or countries.  
3 FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificate at <http://www.nist.gov/groups/ST/comp/documents/140-1-1401val2011.htm#16.35>  
4 Seagate Instant Secure Drive Mode







## Enterprise Performance 10K HDD

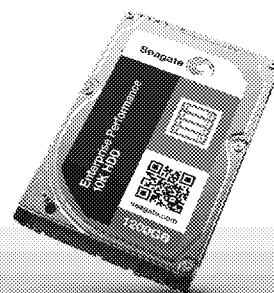
Seagate Enterprise Performance 10K HDDs deliver the optimal balance of capacity, performance and power in a 10K-RPM, 2.5-inch enterprise drive.

### Key Advantages

- Highest-capacity enterprise SFF hard drive (up to 1.2TB)
- PowerChoice™ technology reduces power consumption.
- Protection Information (PI) detects corruption of data in flight between the host system and the drive<sup>5</sup>
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data at rest. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Mission-critical servers and external storage arrays
- Power- and space-constrained data centers
- Compliance or data security initiatives



CAPACITY <sup>1</sup>	5-xx NATIVE MODEL	INTERFACE	CACHE
1200GB	ST1200MM0017 <sup>2</sup>	6Gb/s SAS	64MB
1200GB	ST1200MM0027 <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST900MM0026 <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST900MM0036 <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST9900805SS	6Gb/s SAS	64MB
900GB	ST9900705SS <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST9900605SS <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST9900805FC	4Gb/s FC	64MB
600GB	ST600MM0026 <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600205SS	6Gb/s SAS	64MB
600GB	ST9600105SS <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600005SS <sup>2,3</sup>	6Gb/s SAS	64MB
600GB	ST9600205FC	4Gb/s FC	64MB
450GB	ST450MM0026 <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450405SS	6Gb/s SAS	64MB
450GB	ST9450305SS <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450205SS <sup>2,3</sup>	6Gb/s SAS	64MB
450GB	ST9450405FC	4Gb/s FC	64MB
300GB	ST300MM0026 <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300605SS	6Gb/s SAS	64MB
300GB	ST9300505SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300405SS <sup>2,3</sup>	6Gb/s SAS	64MB
300GB	ST9300605FC	4Gb/s FC	64MB

## Enterprise Performance 15K HDD

Seagate Enterprise Performance 15K HDDs leverage a 2.5-inch form factor to deliver pronounced performance advantages and power savings over legacy 3.5-inch drives.

### Key Advantages

- Stores 2× the Tier 1 data over previous generation without increasing drive count
- Enables Tier 1 applications to process transactions more quickly
- Best-in-class idle power for more efficient storage operations
- Industry's highest MTBF at 2M hours
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS SED<sup>4</sup> options cut IT drive retirement costs and help protect data at rest.

### Best-Fit Applications

- High-performance Tier 1 enterprise servers
- Blade, rack and tower servers hosting transaction-based applications
- Power- and space-constrained data centers
- Compliance and data security initiatives



CAPACITY <sup>1</sup>	5-xx NATIVE MODEL	INTERFACE	CACHE
300GB	ST9300653SS	6Gb/s SAS	64MB
300GB	ST930053SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300453SS <sup>2,3</sup>	6Gb/s SAS	64MB
146GB	ST9146853SS	6Gb/s SAS	64MB
146GB	ST9146753SS <sup>2</sup>	6Gb/s SAS	64MB
146GB	ST9146653SS <sup>2,3</sup>	6Gb/s SAS	64MB
146GB	ST9146852SS	6Gb/s SAS	16MB
146GB	ST9146752SS <sup>2</sup>	6Gb/s SAS	16MB
146GB	ST9146652SS <sup>2,3</sup>	6Gb/s SAS	16MB
73GB	ST973452SS	6Gb/s SAS	16MB
73GB	ST973352SS <sup>2</sup>	6Gb/s SAS	16MB
73GB	ST973252SS <sup>2,3</sup>	6Gb/s SAS	16MB



## 1200 SSD

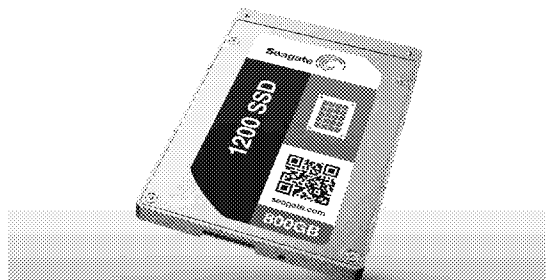
The Seagate 1200 SSD delivers best-in-class performance and a rich enterprise feature set for demanding data center applications.

### Key Advantages

- Helps remove storage bottlenecks and close the gap between processor and data access performance
- Delivers the speed and performance consistency needed for demanding enterprise applications
- Designed to reduce data access wait times under the most complex, write-intensive workloads
- Ensures data availability for critical production systems by using redundant, failover I/O communication paths

### Best-Fit Applications

- IOPS-hungry enterprise applications, such as high-performance computing, online transaction processing and heavy data analytics
- Server-side caching acceleration in virtualized environments
- External enterprise storage solutions (SAN, NAS, DAS)



CAPACITY <sup>1</sup>	MODEL	INTERFACE	SECURITY
800GB	ST800FM0053 <sup>2</sup>	SAS 12Gb/s	SED
800GB	ST800FM0063 <sup>2,3</sup>	SAS 12Gb/s	FIPS 140-2
800GB	ST800FM0043	SAS 12Gb/s	
400GB	ST400FM0073 <sup>2</sup>	SAS 12Gb/s	SED
400GB	ST400FM0053	SAS 12Gb/s	
200GB	ST200FM0073 <sup>2</sup>	SAS 12Gb/s	SED
200GB	ST200FM0053	SAS 12Gb/s	

## Seagate Kinetic Open Storage Platforms

Seagate Kinetic Storage comprises storage devices + key/value API + Ethernet connectivity.

### Key/Value API and Tools Simplify Data Management

- Rapid implementation and deployment in any stack
- Take direct advantage of drive-specific features and capabilities.
- Talk directly to the device at the application level.
- Supports a new class of key/value + Ethernet drives, beginning with HDDs

### Improve Performance in Scale-Out Storage Architectures

The Seagate Kinetic Open Storage platform delivers higher performance and capacity, along with improved rack density, by allowing more flexibility than traditional storage server architectures.

- Simplify scale-out storage architectures
- Break away from the constraints of a legacy storage infrastructure
- Increase I/O efficiency by removing bottlenecks and overhead
- Optimize cluster management, data replication, migration and active archive performance

### Deliver Lower Data Center TCO

- Lowers capital expense (capex) associated with building new or upgrading an existing data center architecture
- Mitigates hardware risks associated with human error
- Lowers operational expense (opex) associated with running a data center
- Improves utilization of real estate where physical footprint is an issue



# Resources and Services

You're never on your own. Get expert advice, do-it-yourself tools, specs and more for all of our products. Seagate Data Recovery Services offers many options for getting your lost data back from all brands and types of storage media. Seagate Partners are eligible to join exclusive programs targeted to the needs of their businesses.

## Data Recovery

Data recovery is a highly technical, labor-intensive process of obtaining usable data from inaccessible storage media and corrupted or deleted file sets from a variety of digital storage media and devices. The process is carried out in a controlled environment using Class 100 clean rooms and Class 10 horizontal flow clean benches to protect client media and all recovery equipment from contamination.

Storage systems can fail in many ways, however, the data stored on them is not necessarily lost. The specific technique used to recover the information depends on the type of failure (file corruption, virus attack, mechanical or electrical problem, or human error). Sometimes these problems occur in combination. Seagate Recovery Services has full-service lab facilities that are prepared to address all failure modes using the industry's most advanced recovery technology and procedures.

### What Types of Media Can Seagate Recover Data From?

- Hard disk drives (all brands and interfaces)
- SSD and flash media
- USB/FireWire drives
- Tape storage (LTO, DLT, AIT, DAT, Travan)
- RAID (0, 1, 3, 4, 5, 6, 10, etc.)
- Servers and virtual machines (VMware, MS Hyper-V)

### Data Recovery Options

- **Seagate Recovery Services:** One-time fixed cost after occurrence of data failure
- **Seagate Rescue and Replace subscription plans:** Available in 2- and 3-year offerings at HDD point of sale.

## Partner Resources and Benefits

The Seagate Partner Program (SPP) provides access to unique resources and benefits to help channel partners secure new opportunities and grow revenue and profitability.

As a registered SPP member, you enjoy the following exclusive features:

- E-newsletter and regular news updates
- New product evaluation unit program
- Training and sales tools portal
- Priority support

Start reaping the rewards of SPP membership—register today at [www.seagate.com/www/partners](http://www.seagate.com/www/partners)

- Complete the online form.
- Click through and accept our standard agreement

 **Partner Program**

## Service and Support

For information regarding products and services, visit [www.seagate.com/about/contact-us/technical-support](http://www.seagate.com/about/contact-us/technical-support)

Available services include:

- Presales and Technical Support
- Global Support Services telephone numbers and business hours
- Authorized Seagate Service Centers

For information regarding Warranty Support, visit [www.seagate.com/support/warranty-and-returns](http://www.seagate.com/support/warranty-and-returns)

For information regarding Data Recovery Services, visit [www.seagate.com/services-software/](http://www.seagate.com/services-software/)

For Seagate OEM and Distribution partner portal, visit [www.seagate.com/www/partners](http://www.seagate.com/www/partners)

For Seagate reseller portal, visit [www.seagate.com/www/partners](http://www.seagate.com/www/partners)

[www.seagate.com](http://www.seagate.com)

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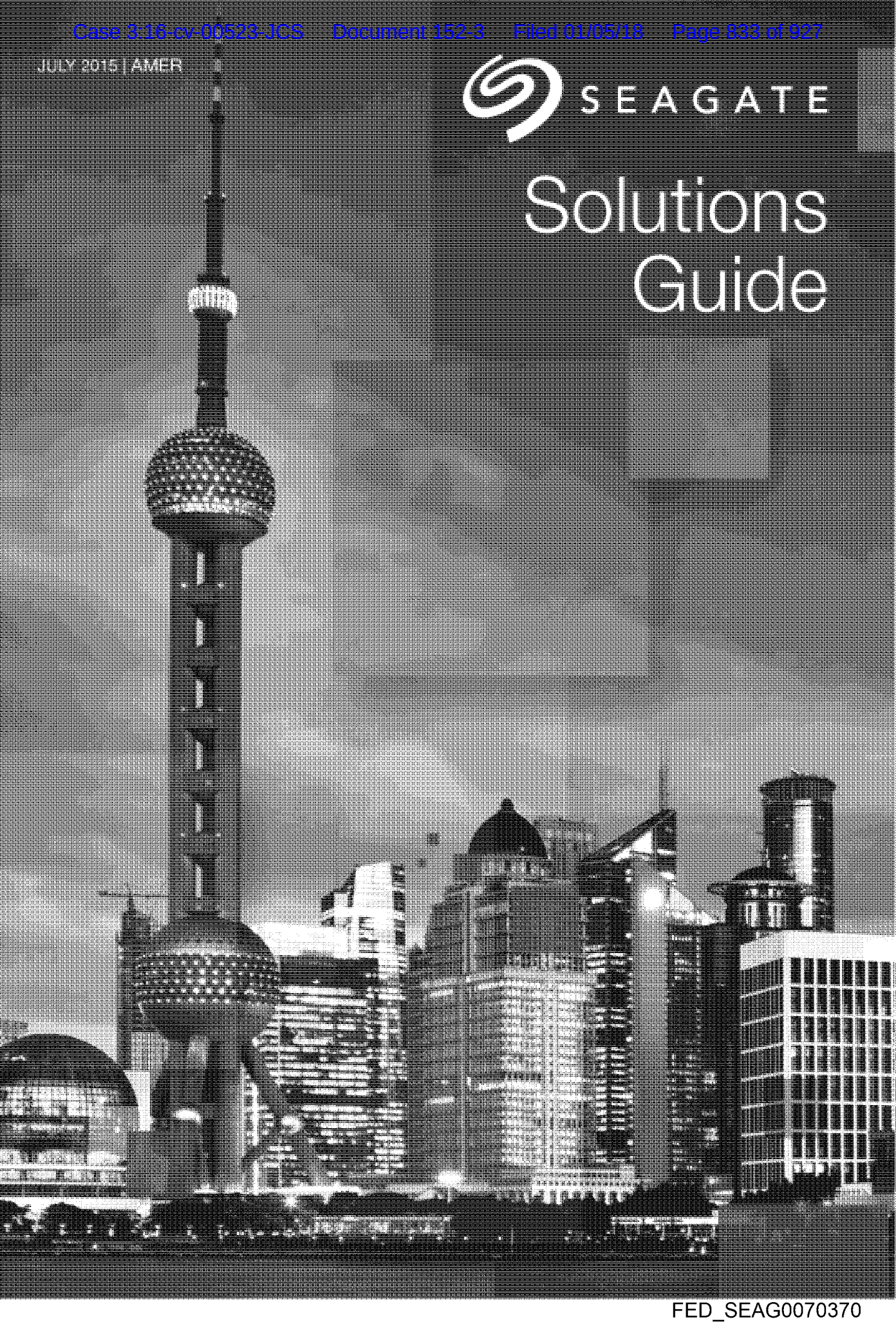


## Exhibit 24

JULY 2015 | AMER



# Solutions Guide





# SPACE TO BE SMART

Ingenious data storage solutions  
for smarter, safer businesses and cities.

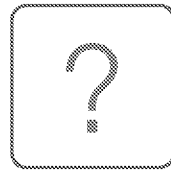
Storage Products ■ Data Services ■ Cloud Solutions



## Harnessing the power of data to do amazing things

Your data is constantly growing and never sleeps. It is alive. From sleek portable hard drives that back up your latest projects, to wireless hard drives that instantly expand the capacity of your phones and tablets, to Open Compute and hyperscale server environments.

It's not just petabytes of data that Seagate stores; it's our libraries, our memories and our ideas. Simply put, it is Us. Seagate gives people peace of mind and has been a storage leader from the beginning. Our dedication to customers and our relationships with OEMs and retailers have made Seagate a trusted source for protecting the world's information.



# Choose your solution

Seagate creates space for the human experience, developing products that enable people and businesses worldwide to create, share and preserve precious memories and critical business data. As demand for information has grown, the need for greater efficiency and advanced storage capabilities continues to evolve. Today data is more than just archived; it is analyzed information with patterns and behavior, full of experiences and memories.

Internal Products			
	Upgrade	Shared Access	Record
YOUR NEED	Increase performance and capacity	Centralized access with 24x7 reliability	Optimized video recording and analytics
OUR SOLUTION	Laptop SSHD Ultra Mobile HDD Laptop Ultrathin HDD Laptop HDD Desktop SSHD Desktop HDD	NAS HDD Enterprise NAS HDD Enterprise Capacity 3.5 HDD	Video 2.5 HDD Video 3.5 HDD Surveillance HDD Enterprise Capacity 3.5 HDD
APPLICATION	Personal Mobile Slim Devices Personal Desktop	Network-Attached Devices SMB/Midrange Enterprise Private Cloud	Surveillance Systems DVR or NVR Systems Set-Top Boxes

External Products				
	Backup	Stream	Share	Access
YOUR NEED	Protect your digital life	Expand your tablet and phone	Turn your home into a personal cloud	Optimize your business with network-attached storage
OUR SOLUTION	Backup Plus Portable Backup Plus Slim Backup Plus Fast Seven Expansion Portable Backup Plus Desktop Expansion Desktop	Wireless Wireless Plus	Personal Cloud	NAS NAS Pro Business Storage Windows Server
APPLICATION	Laptop & Desktop	Tablet & Phone	Laptop, Desktop, Tablet, Phone & TV	Laptop, Desktop, Tablet & Phone

Data Center Products			
	Compute	Store	Archive
YOUR NEED	Intensive processing power needed for mission-critical applications	Massive nearline storage for bulk data, requiring 24x7 operation	Cost-effective storage for less frequently accessed data
OUR SOLUTION	Nytro® Flash Card 1200 SSD Enterprise Performance 15K HDD Enterprise Performance 10K HDD	Enterprise Capacity 3.5 HDD Enterprise Capacity 2.5 HDD Terascale® HDD Kinetic HDD	Archive HDD
APPLICATION	High-Performance Computing Big Data Analytics Transaction Processing	Content Storage Cloud Hyperscale Object-Based Storage	Cold Storage Data Archiving



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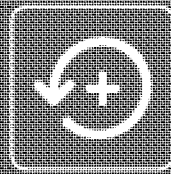


# External Products

Seagate external storage solutions are sleek, dependable products that let your customers automatically and continuously store digital family photos, protect and access critical business data, back up multiple computers on a small network, and stream and share videos and music.

 Backup	 Stream	 Share	 Access
Protect your digital life	Expand your tablet and phone	Turn your home into a personal cloud	Optimize your business with network-attached storage
Backup Plus Portable Backup Plus Slim Backup Plus Fast Seven Expansion Portable Backup Plus Desktop Expansion Desktop	Wireless Wireless Plus	Personal Cloud	NAS NAS Pro Business Storage Windows Server
Laptop & Desktop	Tablet & Phone	Laptop, Desktop, Tablet, Phone & TV	Laptop, Desktop, Tablet & Phone





# Backup

Seagate offers the widest range of portable and desktop drives in many colors and finishes with capacities from 500GB to 8TB. All drives allow easy backup, whether you are at home or away; they help protect your entire digital life locally, in the cloud, from mobile devices or from social networks.

	Seven	Backup Plus Portable	Backup Plus Slim	Backup Plus Fast	Expansion Portable	Backup Plus Desktop	Expansion Desktop
Perfect for	Sleek portable storage	High-capacity portable storage	Portable storage or backup	High performance and capacity storage	Additional portable storage	Backup or add-on storage	Add-on storage
Capacity	500GB	4TB	2TB, 1TB, 500GB	4TB	2TB, 1TB, 500GB	8, 6, 5, 4, 3, 2TB	8, 4, 3, 2TB
Compatibility	PC, Mac	PC, Mac	PC, Mac	PC, Mac	PC	PC, Mac	PC
Portable	Yes	Yes	Yes	Yes	Yes		

## Backup Plus Portable

The Backup Plus Portable Drive offers the mobility of a portable with the high capacity of a desktop drive.

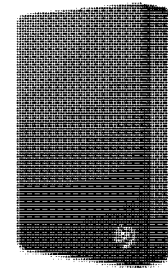
4TB | USB 3.0 | PC, Mac

### Key Advantages

- Mobility of a portable drive with the high capacity of a desktop drive
- Large 4TB capacity to store and carry your movie, music and photo collections
- Up to 53.6% thinner than comparable 4TB drives
- Easy, flexible backups for your computers, tablets and smartphones

### Best-Fit Applications

- Store and carry large digital media libraries
- Backup for all your devices and social networks in one drive
- Portable design, completely bus powered



PRODUCT DIMENSIONS (1TB, 2TB)	4.508-in L x 3.071-in W x 0.807-in D (114.5mm x 78mm x 20.5mm)
PACKAGE DIMENSIONS	5.748-in L x 4.134-in W x 1.693-in D (146mm x 105mm x 43mm)

## Backup Plus Slim Portable

The Backup Plus Slim Portable Drive is the simple way to protect and share your entire digital life.

500GB – 2TB | USB 3.0 | PC, Mac

### Key Advantages

- Thinnest 2TB portable drive available, up to 42% thinner
- Easy, flexible backups
- Backup photos and videos from smart phones and tablets
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click

### Best-Fit Applications

- Store or back up photos, movies, music and documents
- Mobile device backup
- Download and save content that's posted on your social networks



Black Silver Blue Red

PRODUCT DIMENSIONS (1TB, 2TB)	4.47-in L x 2.99-in W x 0.48-in D (113.5mm x 76mm x 12.1mm)
PRODUCT DIMENSIONS (500GB)	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)
PACKAGE DIMENSIONS	5.71-in L x 4.11-in W x 1.28-in D (145mm x 104.5mm x 32.5mm)

## Backup Plus Slim Portable for Mac

The Backup Plus Slim Portable Drive for Mac is the simple way to protect and share your entire digital life.

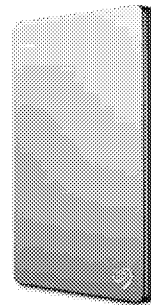
500GB – 2TB | USB 3.0 | PC, Mac

### Key Advantages

- Mac OS and Time-Machine ready out of the box
- Back up photos and videos from smart phones and tablets
- Automatically saves photos from social networks

### Best-Fit Applications

- Store or back up photos, movies, music and documents
- Mobile device backup
- Download and save content that's posted on your social networks



PRODUCT DIMENSIONS (1TB, 2TB)	4.47-in L x 2.99-in W x 0.48-in D (113.5mm x 76mm x 12.1mm)
PRODUCT DIMENSIONS (500GB)	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)
PACKAGE DIMENSIONS	5.71-in L x 4.11-in W x 1.28-in D (145mm x 104.5mm x 32.5mm)

## Backup Plus Fast Portable

The Backup Plus Fast Portable Drive has up to 2x the capacity and performance of other portable drives.

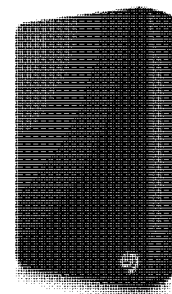
4TB | USB 3.0 | PC, Mac

### Key Advantages

- Up to 2x faster than other portable drives, up to 220MB/s
- No external power supply required
- Back up content from smart phones, tablets and computers

### Best-Fit Applications

- High data traffic applications such as video editing and streaming
- Carry your entire digital library with you on the go
- Portable design, completely bus powered
- Mobile device backup



PRODUCT DIMENSIONS	4.602-in L x 3.248-in W x 0.880-in D (116.90mm x 82.50mm x 22.35mm)
PACKAGE DIMENSIONS	5.787-in L x 5.236-in W x 1.850-in D (147mm x 133mm x 47mm)

## Seven<sup>mm</sup>

The Seven Portable Drive exemplifies advanced storage R&D with world-class industrial design to create the slimmest way to carry 500GB of data.

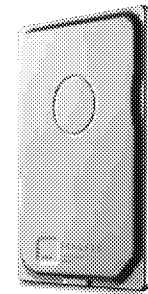
500GB | USB 3.0 | PC, Mac

### Key Advantages

- Celebrates over 35 years of storage expertise and innovation at only 7mm slim
- Seagate's most advanced 5mm drive technology
- Precision-crafted, super-thin 100% stainless steel enclosure
- Stylish, premium braided USB 3.0 cable
- Compatible with Windows and Mac without setup or installation

### Best-Fit Applications

- Elegant and stylish data storage
- Rugged, ultra-portable storage for photo, movies, music and documents
- Mobile device backup
- Cross-platform Windows and Mac file transfer



PRODUCT DIMENSIONS	0.276-in L x 3.228-in W x 4.823-in D (7mm x 82mm x 122.5mm)
PACKAGE DIMENSIONS	0.866-in L x 6.024-in W x 6.024-in D (22mm x 153mm x 153mm)

## Expansion Portable

The Expansion Portable Drive is compact and perfect for taking large files with you on the go.

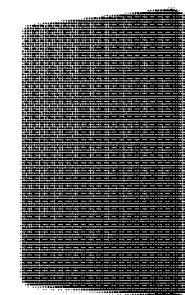
500GB – 2TB | USB 3.0 | PC

### Key Advantages

- Simple and straightforward setup
- Powered from the USB cable
- Saving files is easy—simply drag and drop
- USB 3.0 interface allows fast transfer speeds

### Best-Fit Applications

- Instantly add more storage space to your computer
- Take large files with you when you travel



PRODUCT DIMENSIONS	4.61-in L x 3.15-in W x 0.58-in D (117mm x 80mm x 14.8mm)
PACKAGE DIMENSIONS	5.51-in L x 4.06-in W x 1.22-in D (140mm x 103mm x 31mm)



# Backup Plus Desktop

The Backup Plus Desktop Drive is the simple, one-click way to protect and share your entire digital life.

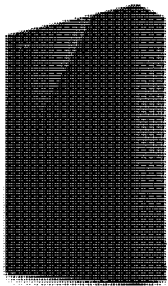
2TB – 8TB | USB 3.0 | PC, Mac

### Key Advantages

- Easy, flexible backups
- Back up photos and videos from smart phones and tablets
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Mobile device backup
- Download and save content that's posted on your social networks



PRODUCT DIMENSIONS	7.063-in L x 4.650-in W x 1.634-in D (179.4mm x 118.10mm x 41.50mm)
PACKAGE DIMENSIONS	8.346-in L x 8.583-in W x 2.677-in D (212mm x 218mm x 68mm)

# Expansion Desktop

The Expansion Desktop Drive provides extra storage for your ever-growing collection of files.

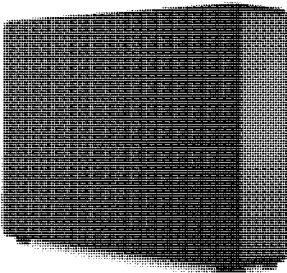
2TB – 5TB | USB 3.0 | PC

### Key Advantages

- Simple and straightforward setup
- No software to install and nothing to configure
- Saving files is easy—simply drag and drop
- USB 3.0 interface allows fast transfer speeds

### Best-Fit Applications

- Instantly add more storage space to your computer
- Improve performance on your computer's internal drive by freeing up space on your internal drive



PRODUCT DIMENSIONS	6.93-in L x 4.75-in W x 1.44-in D (176mm x 120.60mm x 36.60mm)
PACKAGE DIMENSIONS	8.58-in L x 8.35-in W x 2.68-in D (218mm x 212mm x 68mm)

# Backup Plus Desktop for Mac

The Backup Plus Desktop Drive for Mac is the simple, one-click way to protect and share your entire digital life.

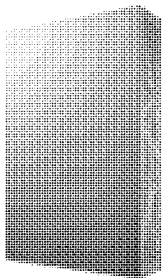
2TB – 4TB | USB 3.0 | PC, Mac

### Key Advantages

- Back up photos and videos from smartphones and tablets
- Mac OS and Time Machine ready right out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click

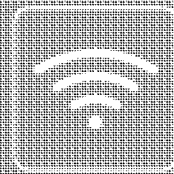
### Best-Fit Applications

- Mobile device backup
- Back up all your important files
- Download and save content that's posted on your social networks
- Share your digital memories to your social networks with a click.



PRODUCT DIMENSIONS	7.063-in L x 4.650-in W x 1.634-in D (179.4mm x 118.10mm x 41.5m)
PACKAGE DIMENSIONS	8.346-in L x 8.583-in W x 2.677-in D (212mm x 218mm x 68mm)





# Stream

Seagate offers two versions of compelling portable drives in a variety of high capacities that can stream your content wirelessly. No wires, no Web. Bring along hundreds of movies and thousands of songs, photos and files to stream to your tablet or smartphone — anytime, anywhere. When streaming wirelessly, consumers don't have to worry about maxing out the capacity of their favorite device or their data usage plan.

	Wireless Plus	Wireless
Perfect for:	Mobile storage for tablets and smartphones	Mobile storage for tablets and smartphones
Capacity:	500B, 1TB, 2000GB	500GB
Interface:	Wi-Fi and USB 3.0	Wi-Fi and USB 3.0
Compatible Platform:	PC, Mac, Android, iOS, Kindle	PC, Mac, Android, iOS, Kindle
Simultaneous Device Streaming:	Up to 5	Up to 3



## Wireless

With Wireless Mobile Device Storage, you can stream your media and access your files without wires or the Internet.

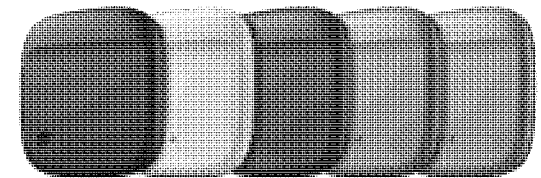
500GB | USB 2.0 | PC, Mac, Mobile Devices

### Key Advantages

- Take your media library with you on the go
- Share media with up to three Wi-Fi enabled devices at the same time
- Use anywhere, without an Internet connection

### Best-Fit Applications

- Store and carry movies and other media on the go
- Share media with others



PRODUCT DIMENSIONS	4.94-in L x 4.93-in W x 0.965-in D (125.36mm x 125.36mm x 24.5mm)
PACKAGE DIMENSIONS	6.02-in L x 2.0-in W x 6.54-in D (153mm x 51mm x 166mm)

## Wireless Plus

With Wireless Plus Mobile Device Storage, you can enjoy your media and access your files without wires or the Web.

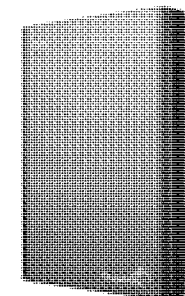
500GB – 2TB | USB 3.0 | PC, Mac, Mobile Devices

### Key Advantages

- Synchronize your Dropbox and Google Drive folders to Wireless Plus
- Take your media library with you on the go
- Share media with up to eight Wi-Fi enabled devices at the same time
- Use anywhere, without an Internet connection
- Up to 10 hours battery life

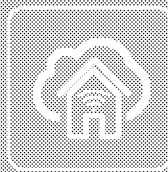
### Best-Fit Applications

- Store and carry movies and other media on the go
- Share media with others
- Works with iOS and Android smartphones and tablets, Amazon Kindle Fire tablets and Windows 8 PCs and tablets



PRODUCT DIMENSIONS	5.00-in L x 3.50-in W x 0.8-in D (127mm x 89mm x 21mm)
PACKAGE DIMENSIONS	6.02-in L x 2.0-in W x 7.16-in D (153mm x 51mm x 182mm)





# Share

Customers are looking for lots of capacity and a cool, secure place to load and store all of their favorite music and movies along with a lifetime of photos. Wherever there is an Internet connection, there is always a way back home to a Personal Cloud. Stream and share all content to top-selling Smart TVs and mobile devices.

	Personal Cloud	Personal Cloud 2-bay
Perfect for	Home media storage	Home media storage, with double protection for files
Number of Drives	1 drive	2 drives
Capacities	5, 4, 3TB	8, 6, 4TB
Features	<ul style="list-style-type: none"><li>Automatic backup for PC, Mac and mobile devices</li><li>Streams media to Samsung TV, Apple TV, Roku, LG TVs, Chromecast, or DLNA</li><li>Remotely access files from PC or Mac with Seagate™ software and from mobile devices with the Seagate Media App</li></ul>	

## Personal Cloud, Personal Cloud 2-bay

Personal Cloud Home Media Storage allows you to create your very own cloud that is accessible outside the home.

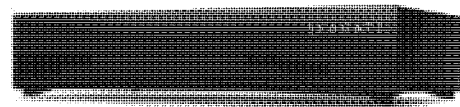
3TB – 8TB | GigE | PC, Mac, Mobile Devices

### Key Advantages

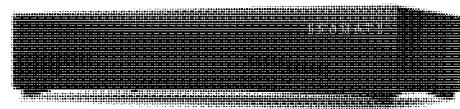
- Centralized backup for multiple computers
- Stream your media library to gaming consoles, media players and smart TVs
- Access your files on-the-go from computers, tablets and smartphones

### Best-Fit Applications

- Consolidate content on one easily accessible device
- Secure remote access from any computer mobile device
- Share with anyone and any device in a connected home



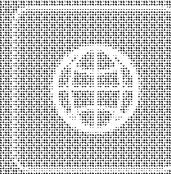
PERSONAL CLOUD	
PRODUCT DIMENSIONS	5.7-in L x 8.5-in W x 1.7-in D (145mm x 216mm x 42mm)
PACKAGE DIMENSIONS	3.15-in L x 10.3-in W x 9.25-in D (80mm x 261mm x 235mm)



PERSONAL CLOUD 2-BAY	
PRODUCT DIMENSIONS	59.21-in L x 9.25-in W x 1.89-in D (234mm x 235.15mm x 48mm)
PACKAGE DIMENSIONS	4.21-in L x 11.29-in W x 13.3-in D (107mm x 287mm x 338mm)







## Access

The Seagate NAS family, available in capacities up to 30TB, allows companies to spend valuable time focused on growing the business and less time worrying if critical files are secure or accessible. With the easy-to-use NAS OS 4 on board, customers can keep their team working efficiently, sharing and managing their projects like never before and from anywhere.

	NAS 2-Bay	NAS 4-Bay	NAS Pro 2-Bay	NAS Pro 4-Bay	NAS Pro 6-Bay
Performance	Small business <25 employees	Small business <25 employees	Small business >25 employees	Small business >25 employees	Small business >25 employees
Capacity	6TB 12 x 6TB 8TB 24 x 4TB 16TB 24 x 2TB 24TB 12 x 8TB 30TB 12-bay	30TB 4 x 8TB 16TB 4 x 4TB 40TB 16 x 2TB 48TB 12 x 2TB 112TB 16-bay	30TB 24TB 48TB 24TB 30TB	30TB 16TB 48TB 48TB 0TB	30TB 24TB 48TB 48TB 0TB
Processor	ARM 1.2GHz	ARM 1.2GHz	ARM 1.2GHz	ARM 1.2GHz	ARM 1.2GHz
Drive Class	NAS HDD	NAS HDD	NAS HDD	NAS HDD	NAS HDD
Ultimate backup	Yes, via Sdrive™ NAS or NAS to cloud storage	Yes, via Sdrive™ NAS or NAS to cloud storage	Yes, via NAS to cloud or Sdrive to cloud storage	Yes, via NAS to cloud or Sdrive to cloud storage	Yes, via Sdrive to NAS or Sdrive to cloud storage
Warranty, limited	3 years	3 years	3 years	3 years	3 years



## NAS 2-bay, 4-bay

The Seagate NAS Family is a full-featured network storage solution offering the easiest setup and the industry's most intuitive interface.

2-bay: 0TB – 10TB | GigE | PC, Mac

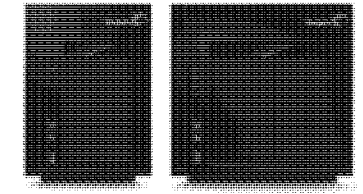
4-bay: 0TB – 20TB | GigE | PC, Mac

### Key Advantages

- Effortlessly configure and set up multiple devices with NAS OS 4
- Ideal for businesses with up to 25 employees
- Seagate NAS HDDs engineered to run 24x7
- Seagate Sdrive™ gives intuitive access from any place and device

### Best-Fit Applications

- Make automatic, continuous backups
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected devices
- Create cost-effective, private cloud storage
- Encrypt individual files to entire volumes of data



### NAS 2-BAY

PRODUCT DIMENSIONS 4.724-in W x 8.543-in H x 6.791-in D  
(120.00mm x 217.00mm x 172.5mm)

PACKAGE DIMENSIONS 10.63-in W x 12.441-in H x 9.055-in D  
(270.00mm x 316.00mm x 230.00mm)

### NAS 4-BAY

PRODUCT DIMENSIONS 6.811-in W x 8.543-in H x 6.791-in D  
(173.00mm x 217.00mm x 172.5mm)

PACKAGE DIMENSIONS 12.756-in W x 12.441-in H x 9.055-in D  
(324.00mm x 316.00mm x 230.00mm)

## NAS Pro 2-bay, 4-bay, 6-bay

Seagate NAS Pro Family is perfect for a growing business with increased storage demands looking to access their own secure, private cloud anywhere, anytime.

2-bay: 0TB – 10TB | GigE | PC, Mac

4-bay: 0TB – 20TB | GigE | PC, Mac

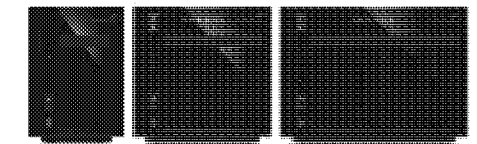
6-bay: 0TB – 30TB | GigE | PC, Mac

### Key Advantages

- Effortless and intuitive interface with NAS OS 4 makes managing content a breeze
- Accessible anywhere, Internet connectivity is available without learning anything new with Sdrive™
- File History and Time Machine backup compatible
- NAS HDD comes with the reliability and performance needed for any business

### Best-Fit Applications

- Small business with up to 50 employees
- NAS OS 4 works seamlessly with both PC and Mac environments
- Creative professionals looking to collaborate high speeds
- Capacity expansion capabilities with Seagate SimplyRAID™



### NAS PRO 2-BAY

PRODUCT DIMENSIONS 4.724-in W x 8.543-in H x 6.791-in D  
(120.00mm x 217.00mm x 172.5mm)

PACKAGE DIMENSIONS 10.63-in W x 12.441-in H x 9.055-in D  
(270.00mm x 316.00mm x 230.00mm)

### NAS PRO 4-BAY

PRODUCT DIMENSIONS 6.811-in W x 8.543-in H x 6.791-in D  
(173.00mm x 217.00mm x 172.5mm)

PACKAGE DIMENSIONS 12.756-in W x 12.441-in H x 9.055-in D  
(324.00mm x 316.00mm x 230.00mm)

### NAS PRO 6-BAY

PRODUCT DIMENSIONS 9.252-in W x 8.543-in H x 6.791-in D  
(235.00mm x 217.00mm x 172.5mm)

PACKAGE DIMENSIONS 15.118-in W x 12.985-in H x 9.806-in D  
(384.00mm x 320.00mm x 244.00mm)





# WSS NAS 2-bay, 4-bay, 6-bay

Seagate WSS NAS Network Storage is a powerful, affordable, easy-to-use, cloud-ready solution for small businesses with up to 50 users.

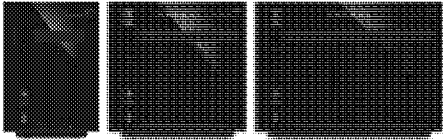
- 2-bay: 0TB – 4TB | GigE | PC
- 4-bay: 0TB – 8TB | GigE | PC
- 6-bay: 0TB – 12TB | GigE | PC

## Key Advantages

- Native cloud integration and connectivity to the Microsoft ecosystem
- Native support for Active Directory lets you simplify setup and manage users through an existing directory
- Simplified collaboration
- Secure remote access

## Best-Fit Applications

- Branch offices with up to 50 employees
- Growing businesses utilizing Windows IT infrastructure
- Centralize management and integration with other Windows Servers



WSS NAS 2-BAY	
PRODUCT DIMENSIONS	4.72-in W × 8.543-in H × 6.791-in D (120.00mm × 217.00mm × 172.5mm)
PACKAGE DIMENSIONS	10.63-in W × 12.441-in H × 9.055-in D (270.00mm × 316.00mm × 230.00mm)

WSS NAS 4-BAY	
PRODUCT DIMENSIONS	6.811-in W × 8.543-in H × 6.791-in D (173.00mm × 217.00mm × 172.5mm)
PACKAGE DIMENSIONS	12.756-in W × 12.441-in H × 9.055-in D (324.00mm × 316.00mm × 230.00mm)

WSS NAS 6-BAY	
PRODUCT DIMENSIONS	9.252-in W × 8.543-in H × 6.791-in D (235.00mm × 217.00mm × 172.5mm)
PACKAGE DIMENSIONS	15.118-in W × 12.985-in H × 9.606-in D (384.00mm × 320.00mm × 244.00mm)





# Internal Products

Seagate has the industry's broadest portfolio of drives created and tailored specifically for your applications. Seagate's full line of solid state hybrid drives (SSHD) provide you with the capacity you need and the performance you crave for your games and other applications running on desktop and laptop PCs. Seagate's portfolio of 24x7 NAS drives is designed to optimize consumer, business and enterprise applications. Seagate also has drives designed specifically for the unique workloads of surveillance and video recording systems. Choose the Seagate drive that's best for you.

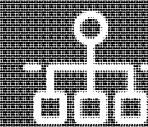


## Upgrade

Increase performance  
and capacity

Laptop SSHD  
Laptop HDD  
Laptop Ultrathin HDD  
Ultra Mobile HDD  
Desktop SSHD  
Desktop HDD

Personal Mobile  
Slim Devices  
Personal Desktop

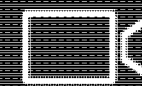


## Shared Access

Centralized access  
with 24x7 reliability

NAS HDD  
Enterprise NAS HDD  
Enterprise Capacity 3.5 HDD

Network-Attached Devices  
SMB/Midrange Enterprise  
Private Cloud



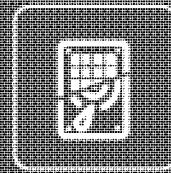
## Record

Optimized video recording  
and analytics

Video 2.5 HDD  
Video 3.5 HDD  
Surveillance HDD  
Enterprise Capacity 3.5 HDD

Surveillance Systems  
DVR or NVR Systems  
Set-Top Boxes





## Upgrade

The best reason to upgrade a drive is to increase performance. If you know gamers, you know they're always looking to edge out the competition. Upgrading the hard drive improves the overall performance of your system and may extend the life of the system itself.

	Laptop SSHD	Laptop HDD	Laptop Ultrathin HDD	Ultra Mobile HDD	Desktop SSHD	Desktop HDD
Perfect for	Performance laptop, gaming laptop	Standard or thin laptop	Tablets, ultrabooks	Tablets, ultrabooks	Performance and gaming desktop	Desktop computer
Capacity	1TB, 500GB	2TB, 1TB, 100GB, 320GB, 250GB	500GB, 320GB	500GB	4TB, 2TB, 1TB	4TB, 3TB, 2TB, 1.5TB, 1TB, 500GB, 250GB
Performance	Up to 4x faster than standard laptop hard drive	Excellent performance	Mainstream	Mainstream	Up to 5x faster than standard desktop hard drive	Excellent performance
Key Feature	Faster boot time	Encryption	Lightweight	Rugged	Faster boot time	DiskWizard™ software
Form Factor	2.5-inch	2.5-inch	2.5-inch	2.5-inch	3.5-inch	3.5-inch
z-Height	9mm, 7mm, 5mm	9mm, 7mm, 5mm	5mm	5mm		
Upgrade Kit Available	Yes	Yes			Yes	Yes
Warranty Limited	3 years	2 years	2 years	2 years	3 years	2 years

## Laptop SSHD, Laptop Thin SSHD

Boot faster. Load faster. Shoot faster.

500GB – 1TB | SATA 6Gb/s | 7mm, 9.5mm

### Key Advantages

- Easy PlayStation or laptop upgrade saves time and improves productivity
- Hybrid drives fuse the blazing speed of SSD with the high capacity of a hard drive
- Performs up to 5x faster than a traditional 7200-RPM HDD
- Thin 9.5mm drive for mobile devices
- Seagate Secure™ Self-Encrypting Drive (SED) options



### Best-Fit Applications

- Laptops, desktops, ultrabooks and tablets
- High-performance gaming systems
- Small form factor all-in-one PCs

## Laptop HDD, Laptop Thin HDD

Feature-rich, slim, lightweight style at price and capacity points that enable no-compromise designs for thin computing

Laptop: 1TB – 2TB | SATA 6Gb/s | 9.5mm

Laptop Thin: 250GB – 500GB | SATA 6Gb/s | 7mm

### Key Advantages

- Available as a Self-Encrypting Drive (SED) and FIPS 140-2 SED
- Compatible with SATA 6Gb/s and 3Gb/s designs
- Backed by a 2-year limited warranty



### Best-Fit Applications

- Traditional laptops
- Small form factor PCs
- Convertible and detachable storage
- Slim consumer electronics devices



## Laptop Ultrathin HDD

3 ounce, 5mm hard drives for ultrabooks and slim laptops with SED option

320GB, 500GB | SATA 6Gb/s | 5mm

### Key Advantages

- The thinnest, lightest and most affordable hard drives designed for slim laptops and ultrabooks
- 5mm, 3.3 oz laptop drive delivers optimum performance in a minimal footprint
- Implement up to 500GB of storage capacity in 25% less space
- Seagate Secure™ Self-Encrypting Drive (SED) option



### Best-Fit Applications

- Slim laptops or ultrabooks
- Extending high-capacity, affordable storage into other applications and slim devices
- Backup storage

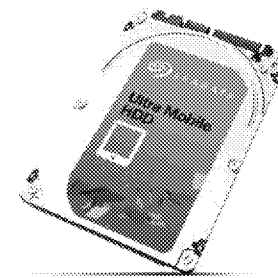
## Ultra Mobile HDD

Just 5mm thin and supported by a stainless steel design, the Seagate Ultra Mobile HDD is ready for mobility.

500GB | SATA 6Gb/s | 5mm

### Key Advantages

- 500GB brings 7x more space to tablet applications at a fraction of the cost
- Zero-gravity sensors provide extra drop protection
- Improved shock and tolerance for gyroscopic motion supports even the intense maneuvers of gamers
- Just 3.3 oz—about the weight of a lightbulb



### Best-Fit Applications

- Tablets
- Convertible and detachable storage
- Ultra-mobile, ultra-portable storage expansion apps

## Desktop SSHD

Solid state hybrid drives deliver speed and capacity for gaming and high-performance desktop applications.

1TB – 4TB | SATA 6Gb/s | 64MB Cache | 8GB MLC Flash

### Key Advantages

- For a richer gaming experience, Seagate SSHDs deliver faster map load speed for non-stop performance and play
- Get the kick of an integrated solid state drive (SSD) with the massive 4TB capacity of a hard drive—all at a surprisingly low price!
- Boots Windows 8 in less than 10 seconds
- Performs up to 5x faster than 7200 RPM desktop hard drives
- Improves overall system responsiveness by 30% or more



### Best-Fit Applications

- Desktop PCs
- Workstations
- High-performance direct-attached storage (DAS) devices

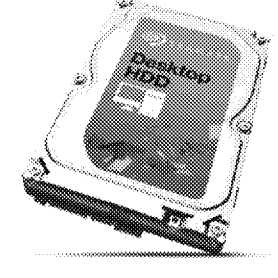
## Desktop HDD

The one drive for every desktop system need, supported by 30 years of trusted performance, reliability and simplicity

250GB – 4TB | SATA 6Gb/s | 64MB Cache

### Key Advantages

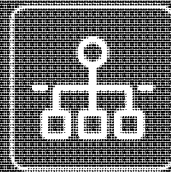
- Store as much desktop data as you need with multiple capacities up to 4TB
- Store data faster with SATA 6Gb/s interface that optimizes burst performance
- Rest easy knowing your drive delivers dependable performance with Seagate AcuTrac™ servo technology
- Have confidence with safe, fast and easy drive retirement provided by Instant Secure Erase feature
- Protect your data with Seagate Secure™ models



### Best-Fit Applications

- Desktop systems
- All-in-one PCs
- Entry-level home servers





## Shared Access

Network-attached storage (NAS) drives are designed to sustain high levels of performance while enduring a 24x7 workload in an enclosure with multiple operating drives. The NAS HDD and the Enterprise NAS HDD are optimized with the highest capacity, robust shock tolerance, silent acoustics and excellent reliability features so you can collaborate, share and stream content from home, the office or your own private cloud.

	NAS HDD	Enterprise NAS HDD	Enterprise Capacity 3.5 HDD
Perfect for	Home, SOHO or small business	Small to medium business	Medium to large business
Application/Use	Desktop RAID, 1- to 8-bay NAS devices	Up to 16-bay rackmount/tower systems	>8-bay rackmount/tower systems
Capacity	4TB, 3TB, 2TB	6TB, 5TB, 4TB, 3TB, 2TB	6TB, 5TB, 4TB, 2TB, 1TB
Power/Balance		Yes	Yes
NASWorks™	Yes		
Rescue Data Recovery Services Plan Option	Yes	Yes	
Warranty, Limited	3 years	3 years	5 years

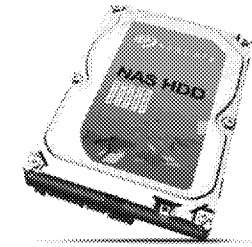
## NAS HDD

Optimize performance and reliability for your 24x7 NAS and RAID workloads in 1- to 8-bay solutions with drives featuring NASWorks™ technology.

2TB – 4TB | SATA 6Gb/s | 64MB Cache

### Key Advantages

- Specifically designed to minimize rotational vibration (RV) effects typically found in multi-drive solutions, improving system performance and reliability
- Advanced power profiles tailor low power options for always-on NAS applications
- Extended error recovery controls help to ensure drives comply with NAS system requirements for better data integrity
- 3-year limited warranty so you can rest easy with your drive choice
- Available with Rescue Data Recovery Services plan



### Best-Fit Applications

- Home servers or desktop NAS solutions
- Small-business file sharing
- Backup servers

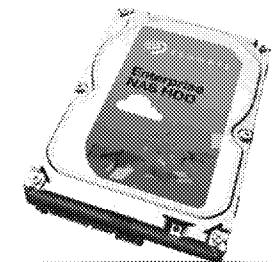
## Enterprise NAS HDD

Designed to combine up to 6TB of industry-leading capacity with reliability and performance for SMB and private cloud NAS and RAID storage systems with 4 to 16 bays

2TB – 6TB | SATA 6Gb/s | 128MB Cache

### Key Advantages

- NAS-optimized performance for higher write workloads often reflected in NAS applications
- RAID Rebuild™ technology speeds up time-consuming complete RAID rebuilds
- Specifically designed to minimize rotational vibration (RV) effects typically found in multi-drive solutions, improving system performance and reliability
- Extended error recovery controls help to ensure drives comply with NAS system requirements for better data integrity
- 5-year limited warranty so you can rest easy with your drive choice
- Available with Rescue Data Recovery Services plan



### Best-Fit Applications

- Backup and disaster recovery
- Multimedia server and storage
- Archiving and cloud replication
- On-premise private cloud





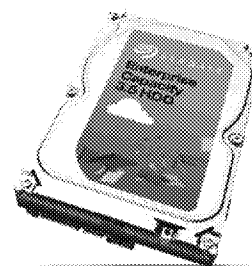
## Enterprise Capacity 3.5 HDD

Store up to 6TB of data without sacrificing performance.

1TB – 6TB | SATA 6Gb/s, 12Gb/s SAS | 128MB Cache

### Key Advantages

- Quickly access and store your data with blazingly fast random and sequential read/write performance
- Enjoy peace of mind with eighth-generation drive technology for reliable access to bulk storage of unstructured data
- Have confidence with a drive that provides rotational vibration tolerance to ensure consistent performance
- Relax with a drive that delivers easy integration into replicated and RAID storage systems with 12Gb/s SAS and SATA 6Gb/s interface options

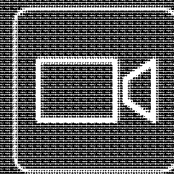


### Best-Fit Applications

- Massive scale-out NAS environments
- High-density NAS solutions
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore—D2D, virtual tape







## Record

Our video and surveillance HDDs are designed to be quiet and reliable in NVR, DVR and surveillance systems. These drives are cost-effective in very demanding consumer environments that need the versatility to go with the higher capacities.

	Video 3.5 HDD	Video 2.5 HDD	Surveillance HDD	Enterprise Capacity 3.5 HDD
Perfect for	Consumer DVR and set-top boxes	Small footprint DVR and set-top boxes	Entry-level SDVR to NVR storage for residential to SMB	Video analytics and optimization, long term video retention
Capacity	4TB, 3TB, 2TB, 1TB, 500GB, 320GB	500GB, 320GB	6TB, 5TB, 4TB, 3TB, 2TB, 1TB	6.5, 4, 3, 2TB
Key Feature	High reliability	Low power	Precision-tuned for surveillance	Encryption, PowerBalance
Cameras Supported			up to 64	100+
Video Streaming Capabilities	Easily manages up to 16 simultaneous HD streams	Easily manages up to 12 simultaneous HD streams		
Recover Data Recovery Services Plan Option			Yes	
Warranty, Limited	3 years	3 years	3 years	5 years

## Video 2.5 HDD

Seagate Video 2.5 HDDs let you stream, record and play back your video content with unparalleled reliability and performance.

320GB – 500GB | SATA 3Gb/s | 16MB Cache

### Key Advantages

- Virtually silent streaming performance as low as 19dB
- Built for 24x7 operation and low power consumption
- Small, 2.5-inch form factor allows system cost reduction and operational power savings
- 0.55% AFR supports longevity in demanding consumer electronic environments



### Best-Fit Applications

- DVR and media center applications
- Home theater PCs
- Karaoke and audio jukeboxes
- Cable, satellite and IPTV set-top boxes
- In-camera or surveillance systems

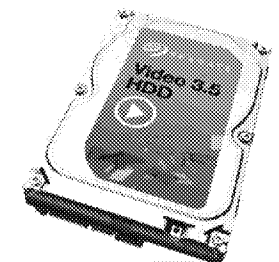
## Video 3.5 HDD

Seagate Video 3.5 HDDs deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

250GB – 4TB | SATA 6Gb/s | 8MB, 64MB Cache

### Key Advantages

- Quiet drive operation to enhance customer viewing and listening experiences
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited



### Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes





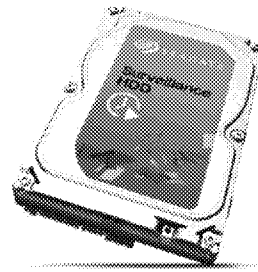
## Surveillance HDD

The Seagate Surveillance HDD is purpose-built surveillance storage that improves video streaming, drive performance and data integrity in surveillance applications.

1TB – 6TB | SATA 6Gb/s | 64MB, 128MB Cache

### Key Advantages

- Precision-tuned for high write surveillance workloads operating 24x7
- Capacities up to 6TB support 8+ drives and up to 64 cameras per system
- Reliably performs in multi-drive systems with RAID support
- Available with Rescue Data Recovery Services plan



### Best-Fit Applications

- Network video recorder (NVR)
- Embedded SDVR
- Hybrid SDVR
- Surveillance DVR

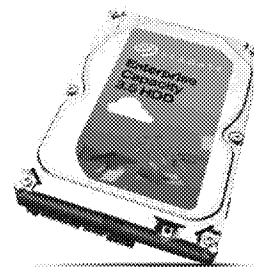
## Enterprise Capacity 3.5 HDD

The Seagate Enterprise Capacity 3.5 HDDs help centralized or cloud surveillance systems and systems leveraging high levels of video analytics.

1TB – 6TB | SATA 6Gb/s, 12Gb/s SAS | 128MB Cache

### Key Advantages

- Highest-capacity enterprise drive for maximum density server and storage solutions
- SAS and SATA interfaces with 24x7 reliability
- Predictable performance even in the most rugged multi-drive environments
- Improved power and cooling efficiencies with low power consumption and on-demand PowerChoice™ technology
- Protect your data and ease data disposal costs and management with the Self-Encrypting Drive (SED)



### Best-Fit Applications



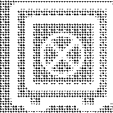
- Massive scale-out surveillance environments
- High-density data centers
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore
- Centralized surveillance



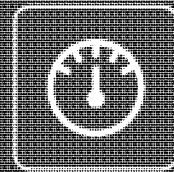


# Data Center Products

Seagate is innovating storage to meet the ever-changing dynamics of IT, enabling our customers to remain competitive and relevant. In addition, Seagate products effectively help solve storage issues within high-performance computing (HPC), transaction processing, bulk data applications, and object-based and cold storage applications.

 <b>Compute</b>	 <b>Store</b>	 <b>Archive</b>
Intensive processing power needed for mission-critical applications	Massive nearline storage for bulk data, requiring 24x7 operation	Cost-effective storage for less frequently accessed data
Nytro® Flash Card 1200 SSD Enterprise Performance 15K HDD Enterprise Performance 10K HDD	Enterprise Capacity 3.5 HDD Enterprise Capacity 2.5 HDD Terascale® HDD Kinetic HDD	Archive HDD
High-Performance Computing Big Data Analytics Transaction Processing	Content Storage Cloud Hyperscale Object-Based Storage	Cold Storage Data Archiving





## Compute

With a lineup of products that ranges from PCIe-based flash cards for hyperconverged, open source and cloud deployments, to SAS solid state drives for demanding database and virtual environments, to 10K and 15K HDDs with TurboBoost™ technology that are the storage backbone of many high-performance systems, Seagate provides the processing power for mission-critical applications like high-performance computing, big data analytics and transaction processing.

	Nytrio®	1200 SSD	Enterprise Performance 15K HDD	Enterprise Performance 10K HDD
Perfect for	HPC, data analytics	Complex, write-intensive workloads	Database, online search, high-performance RAID	File servers, email servers, mid-tier RAID
Capacity	3.2TB, 1.92TB, 1.79TB, 1.75TB, 1.3TB	800GB, 400GB, 200GB	600GB, 300GB	1.6TB, 1.2TB, 900GB, 600GB
Interface	PCIe	12Gb/s SAS	12Gb/s SAS	12Gb/s SAS
Form Factor	Full height, half length and half height, half length	2.5-inch	2.5-inch	2.5-inch
Use in Servers	Yes	Yes	Yes	Yes
Use in Storage Arrays			Yes	Yes

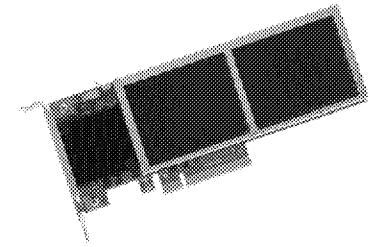
## Nytrio® Flash Accelerator Card

Nytrio Flash Accelerator Cards, with outstanding performance, low latency and improved data center efficiency, are changing how storage is architected.

1.3TB – 3.2TB | PCIe 3.0, PCIe 2.0 | MLC and eMLC Flash

### Key Advantages

- Broadest PCIe-based flash portfolio with solutions tuned to address specific customer challenges
- Delivers high response times, density, improved thermals, endurance and serviceability
- Offload architecture minimizes requirements on host CPU and memory
- Enterprise quality and reliability



### Best-Fit Applications

- Demanding databases
- Web cloud and open source deployments
- Software-defined storage

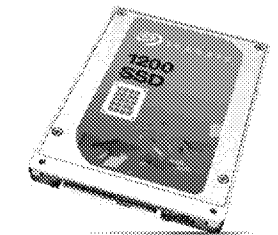
## 1200 SSD

The Seagate 1200 SSD delivers best-in-class performance and a rich enterprise feature set for demanding data center applications.

200GB – 800GB | SAS 12Gb/s | MLC Flash

### Key Advantages

- Helps remove storage bottlenecks and close the gap between processor and data access performance
- Delivers the speed and performance consistency needed for demanding enterprise applications
- Improves ROI by leveraging existing SAS servers, accommodating SAS infrastructure scalability, and a proven SCSI command set
- Features power loss data protection to save data/operations in process
- Ensures data availability for critical production systems by using redundant, failover I/O communication paths



### Best-Fit Applications

- IOPS-hungry enterprise applications
- Server virtualization
- High-performance databases
- Software-defined storage
- External enterprise storage solutions (SAN, NAS, DAS)





## Enterprise Performance 15K HDD

Improve your server response times.

300GB, 600GB | 12Gb/s SAS | 128MB Cache

### Key Advantages

- Complete more transactions in less time with TurboBoost™ technology
- Only 12Gb/s SAS drives certified for VMware Virtual SAN
- Seagate Secure™ drives with Instant Secure Erase for easy disposal
- Protect data with Self-Encrypting Drive (SED) models



### Best-Fit Applications

- High-performance Tier 1 enterprise servers
- Blade, rack and tower servers hosting transaction-based applications
- Power- and space-constrained data centers
- Compliance and data security initiatives

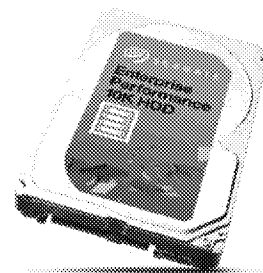
## Enterprise Performance 10K HDD

Perfect balance of high capacity and high performance

600GB – 1.8TB | 12Gb/s SAS | 128MB Cache

### Key Advantages

- Complete more transactions faster with TurboBoost™ enhanced cache
- Low power that data centers need to reduce IT operating costs
- Future-proof with 12Gb/s SAS and Advanced Format options
- Protect data with Self-Encrypting Drive (SED) models

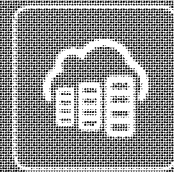


### Best-Fit Applications

- Mission-critical servers and external storage arrays
- Power- and space-constrained data centers
- Green IT and drive-retirement cost reduction initiatives
- Compliance or data security initiatives







## Store

For content storage, cloud hyperscale and object-based storage applications, customers need massive nearline storage for bulk data that is always on and accessible. Customers also can take advantage of an Ethernet-based drive that implements the latest technology from Seagate to help customers design systems that reduce TCO and enable flexibility in response to a growing cloud storage infrastructure.

	Enterprise Capacity 3.5 HDD	Enterprise Capacity 2.5 HDD	Kinetic HDD
Perfect for	High-capacity storage, massive scale-out architectures	Maximum density, small footprint	Scale-out object storage
Capacity	6TB, 5TB, 4TB, 3TB, 2TB, 1TB	2TB, 1TB	4TB
Interface	SATA 6Gb/s, 12Gb/s SAS	SATA 6Gb/s, 12Gb/s SAS	Ethernet
Key Feature	Encryption, PowerBalance	Encryption	Simplifies cloud storage infrastructure
Reliability	2MM hours MTBF	2MM hours MTBF	800K hours MTBF
Form Factor	3.5-inch	2.5-inch	2.5-inch
Servers	Yes		
Storage Arrays	Yes		
JBOD	Yes	Yes	Yes
Warranty, Limited	5 years	5 years	3 years

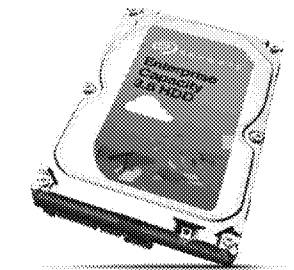
## Enterprise Capacity 3.5 HDD

The Seagate Enterprise Capacity 3.5 HDDs help both private and public data centers meet the demanding growth of unstructured data.

1TB – 6TB | SATA 6Gb/s, 12Gb/s SAS | 128MB Cache

### Key Advantages

- Highest-capacity enterprise drive for maximum density server and storage solutions
- Engineered for 24x7 workloads of 550TB/yr
- Predictable 7200-RPM performance even in the most rugged multi-drive environments
- Improved power and cooling efficiencies with low power consumption and on-demand PowerChoice™ technology
- Protect your data and ease data disposal costs and management with the Self-Encrypting Drive (SED) and FIPS 140-2 certified SED



### Best-Fit Applications

- Massive scale-out storage environments
- High-density data centers
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance
- High-density NAS solutions

## Enterprise Capacity 2.5 HDD

Store large amounts of data without using a ton of space with up to 2TB in storage on a 2.5-inch form factor.

250GB – 2TB | SATA 6Gb/s, 12Gb/s SAS | 128MB Cache

### Key Advantages

- Quickly access high-integrity data in a secure manner with either 12Gb/s SAS or SATA 6Gb/s
- Enjoy peace of mind with this third-generation drive delivering enterprise-class reliability for 24x7 environmental robustness
- Lower your power costs and store data faster with over 50% improvement in watts/TB and 18% sequential performance improvement compared to the previous generation
- Rest easy with maximum system availability and drive performance as a result of improved rotational vibration tolerance and head micro-actuation



### Best-Fit Applications

- Storage-hungry business applications
- Storage area networks and network-attached storage
- Maximum-capacity servers and blade servers
- Rich media content storage
- Enterprise backup and restore—D2D, virtual tape
- Cloud computing





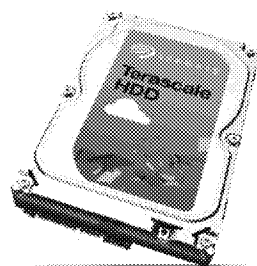
## Terascale® HDD

Store more data with up to 4TB of storage for 24x7 multi-drive replicated environments.

4TB | SATA 6Gb/s | 64MB Cache

### Key Advantages

- Enjoy peace of mind with a reliable enterprise-class performing drive that includes high vibration tolerance
- Save money with a power efficient drive that minimizes power and cooling costs
- Rest easy knowing your data integrity is maintained through Advanced Format logical block management
- Store your data faster through SATA 6Gb/s interface that optimizes burst performance



### Best-Fit Applications

- Web-scale computing
- Cloud storage servers and arrays
- Cloud backup storage
- Direct-attached external storage (DAS)
- Network-attached storage (NAS)

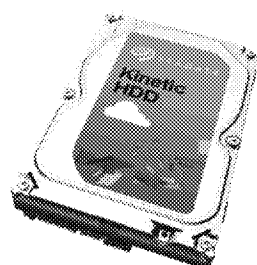
## Kinetic HDD

The Kinetic HDD is the first Ethernet-connected HDD with an open source object API designed for hyperscale and scale-out environments.

4TB | Ethernet | 64MB Cache

### Key Advantages

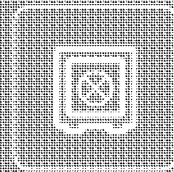
- Reduces TCO by simplifying cloud and data center storage hardware and software stacks
- Improves performance by eliminating layers of antiquated file system software
- Enables flexible and independent scaling of compute and storage growth
- Supports hyperscale 24x7 environments with up to 800 drives in a 40U rack
- Connects storage directly to existing data center data communications fabric



### Best-Fit Applications

- Object data storage
- Hyperscale and scale-out storage
- Cloud storage arrays
- Cloud backup storage





## Archive

One of the most important storage applications is preserving and archiving data that is not necessarily high priority but may still be needed in the future. Seagate offers a drive for cold storage and data applications. It is designed in capacities up to an amazing, supersized 8TB, 24x7 reliability, and with some of the best features in the industry for this type of drive.

Archive HDD

Perfect for	Online archiving, big data cold storage
Capacity	6TB, 8TB, 5TB
Interface	SATA 6Gb/s
Key Feature	Lowest cost per TB
Reliability	Greater, 200K hours MTBF
Form Factor	3.5-inch
JBOD	Yes
Warranty, Limited	5 years

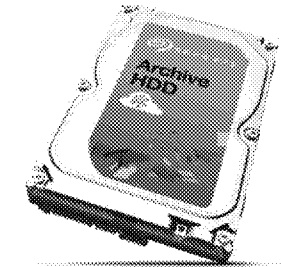
## Archive HDD

Affordable active archive hard drives for cloud storage

5TB – 8TB | SATA 6Gb/s | 128MB Cache

### Key Advantages

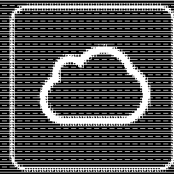
- Efficiently store more data at lower costs with this low cost/GB/watt, 8TB hard drive
- Enjoy peace of mind with a drive engineered for 24x7 workloads of 180TB per year
- Keep your costs down with up to 1.33TB-per-disk hard drive technology
- Store your data faster with SATA 6Gb/s interface that optimizes burst performance
- Have confidence with a drive that provides reliable, low-power data retrieval based on shingled magnetic recording (SMR) technology



### Best-Fit Applications

- Online archiving
- Large data object storage
- Big data cold storage
- Cloud active archive
- Web-scale archiving





# Cloud Systems and Solutions

Seagate Cloud Systems and Solutions builds on the Seagate legacy to extend innovation from the device into the information infrastructure, onsite and in the cloud.



## Cloud Systems and Solutions

Seagate Cloud Systems and Solutions builds on the Seagate legacy to extend innovation from the device into the information infrastructure, onsite and in the cloud.

### High-Performance Computing Storage

High-performance computing (HPC) and big data customers who need to reliably plan, deploy and sustain maximum optimal application performance use Seagate HPC solutions. Our award-winning HPC solutions deliver the fastest time to results, with superior performance and ultra-efficient scalability.

### Modular Storage Systems for OEMs

OEMs and solution integrators use the flexible, extensible, reliable and energy-efficient OneStor™ family of enclosures, controllers, and application platforms to modernize data centers and manage explosive data growth. Seagate has provided OEM customers with over 2 million enclosures and 17,000 petabytes of storage. Seagate delivers quality storage solutions trusted by some of the best known brands in IT.

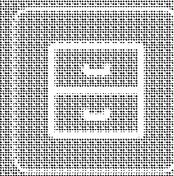
### Scale-Out Storage Systems

Seagate software-independent systems ensure that cloud service providers, independent software vendors, DIY organizations and system integrators can focus on their key value—software development and solution deployment—while enabling them to precisely assess, and therefore control, solution TCO and service delivery. Seagate provides the industry's most trusted open, scalable, modular components and engineered solutions that will speed time to market and boost bottom-line results.

## Hybrid Cloud Solutions

The Seagate portfolio of data protection appliances, backup and recovery software and services, and disaster recovery services, combines the best of private cloud infrastructure and public cloud services, including:

- Seagate Cloud Backup and Recovery Services
- Seagate Cloud Backup and Recovery Appliances
- Seagate Backup and Recovery Software
- Seagate Backup and Recovery Private Cloud
- Seagate Cloud Disaster Recovery Service



## Resources, Services and Support

Whether it is the Seagate Partner Program (SPP), which helps channel partners to succeed, or both the Seagate in-lab recovery services or rescue plans that offer highly technical and specialized data recovery options for most media types, we want you and your customers to get the most out of Seagate storage technologies. Seagate offers an extensive range of customer service options, all backed by more than 30 years of leadership, innovation and excellence.

## Partner Resources and Benefits

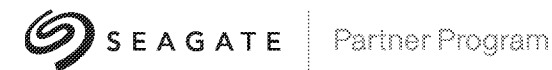
The Seagate Partner Program (SPP) provides access to unique resources and benefits to help channel partners secure new opportunities and grow revenue and profitability.

Exclusive features to help you grow your business:

- Marketing kits, product guides and sales cards
- Online training and brand materials
- Diagnostics and firmware updates
- Priority support and trackers for RMAs
- Regular product updates and industry news

Start reaping the rewards of SPP membership—register today at [www.seagate.com/www/partners](http://www.seagate.com/www/partners)

- Complete the online form
- Click through and accept our standard agreement



## Service and Support

For information regarding products and services, visit [www.seagate.com/about/contact-us/technical-support](http://www.seagate.com/about/contact-us/technical-support)

Available services include:

- Presales and Technical Support
- Global Support Services telephone numbers and business hours
- Authorized Seagate Service Centers

For information regarding Warranty Support, visit [www.seagate.com/support/warranty-and-returns](http://www.seagate.com/support/warranty-and-returns)

For Seagate OEM and Distribution partner portal, visit [www.seagate.com/partners](http://www.seagate.com/partners)

For Seagate reseller portal, visit [www.seagate.com/partners](http://www.seagate.com/partners)



## Data Recovery

Storage systems can fail in many ways due to mechanical or human error, however, the data stored on them is not necessarily lost. Data recovery is a highly technical, labor-intensive and costly process of retrieving usable data from inaccessible storage devices. Seagate Recovery Services (SRS) has full-service lab facilities that are prepared to address all failure modes using the industry's most advanced recovery technology and procedures.

SRS offers multiple solutions to recover your business and personal data from various types and brands of storage devices in a fast and cost-effective manner.

- **In-lab recovery**—Get help fast after occurrence of drive failure or data loss with complimentary 2-way shipping. The in-lab recovery is performed by a team of data-recovery experts and the data can be restored in as little as two days.
- **Recovery software**—A quick and easy process to check drive condition and recover the lost data from minor logical problems without having to ship your drive or device
- **Rescue plans**—Cost-effective and proactive way to protect against future data loss. Available in 2- and 3-year offerings at HDD point of sale.

For information regarding Warranty Support, visit [seagate.com/datarecovery](http://seagate.com/datarecovery)

What Types of Media Can Seagate Recover Data From?

- Hard Disk Drives (all brands and interfaces)
- SSD and Flash Media
- USB/Firewire Drives
- Smartphones
- Tablets
- RAID (0, 1, 3, 4, 5, 6, 10, etc.)



## Glossary

### AcuTrac™

Seagate AcuTrac technology places a secondary actuator further down the suspension arm, bringing it closer to the head and therefore tightening control. The secondary nano-actuator fundamentally enables TPI improvement by directing the head more accurately to individual tracks, even at the nanometer scale.

### Adaptive Memory™

Seagate Adaptive Memory technology effectively identifies the most frequently used data and stores it in the NAND flash. The results give you greatly improved boot times, application loads and overall system responsiveness. Available on SSHDs.

### Battery life

Exact battery life is subject to product model, normal usage conditions and configurations.

### Capacity

One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

### Data encryption and protection

Self-Encrypting Drives (SED) encrypt all user data using a data encryption key stored securely on the drive itself. The manner in which data is encrypted depends on the level of security implemented. Each level includes the protection capabilities of the previous levels.

- Quick and easy data erasure and sanitize features for secure drive repurposing (Seagate Instant Secure Erase, or ISE)
- Data-at-rest protection (SED). SEDs are not available in all models or countries. May require TCG-compliant host or controller support.
- Data-at-rest and tamper evidence protection (FIPS). Refer to the FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/consp/documents/140-1/1401vend.htm> for more specific information.

(See also Seagate Secure.)

### DiscWizard™

DiscWizard software lets you quickly and easily install your new hard drive. It guides you through the processes of creating and formatting partitions on your hard drive, transferring data and backing up your data.

### Error recovery control (ERC)

Error recovery control helps ensure drives remain active in a RAID environment by averting unwarranted drive swaps and RAID rebuilds. ERC boosts RAID performance by flagging disks slowed by errors; it alerts RAID of the need for data reconstruction and rewrite to resolve disk errors and restore speed.

### NASWorks™

Improves drive reliability with custom-built error recovery controls, power settings and vibration tolerance on Seagate NAS HDDs.

### Performance

Performance is tested and varies depending on user's hardware configuration and operating system.

### Power Balance

Seagate PowerBalance technology offers random workload power savings and best-in-class sequential performance with all the benefits of conventional technologies. By utilizing Seagate-unique firmware algorithms, PowerBalance trades off seek performance for operational power savings.

### PowerChoice™

Seagate PowerChoice technology supports four customizable modes to give businesses significantly more control of power usage by allowing for up to a 54% reduction in the amount of energy used.

### RAID Rebuild™

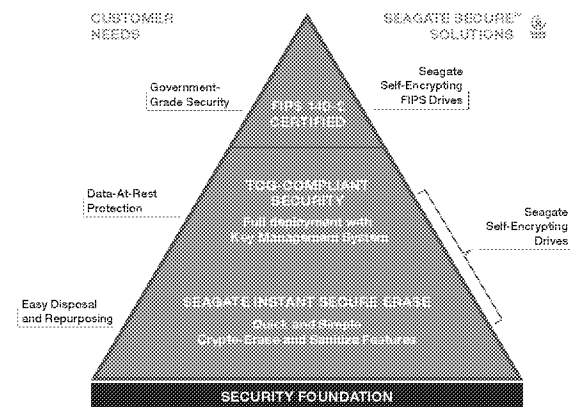
RAID Rebuild technology mitigates time-consuming complete RAID rebuilds by extracting as much data as possible from the failed drive before initiating RAID recovery.

### Sdrive™

The Seagate Sdrive app is the easiest, most intuitive way to connect to your NAS if you're away from the office and need to look for or grab a file. From any desktop or laptop, access your NAS by clicking the Sdrive icon.

### Seagate Secure™

With Seagate Secure drives, users securely manage data stored on their systems with no performance degradation and can securely erase all of their data, if needed, in a matter of seconds.



### Sector size

A subdivision of a track on the physical disk. Hard drive companies are migrating from 512 bytes to a larger, more efficient sector size of 4096 bytes, referred to as 4K.

### SimplyRAID™

Seagate's efficient and easy-to-use RAID solution. SimplyRAID technology builds in the background, allowing users to add and share files with no downtime. SimplyRAID lets you choose redundancy for one drive failure or redundancy for two drive failures.

### Solid state hybrid drive (SSHD)

SSHD technology integrates a small amount of NAND flash into the HDD architecture to produce a combined benefit: the capacity of a hard drive and speed similar to an SSD assisted by Seagate Adaptive Memory technology.

### TurboBoost™

An enhanced cache option that helps to complete more transactions in less time by accelerating I/O operations with TurboBoost enhanced cache option.

### Zero Gravity Sensor

Seagate Zero Gravity Sensor (ZGS) provides extra protection when a device or system is dropped.

[www.seagate.com](http://www.seagate.com)

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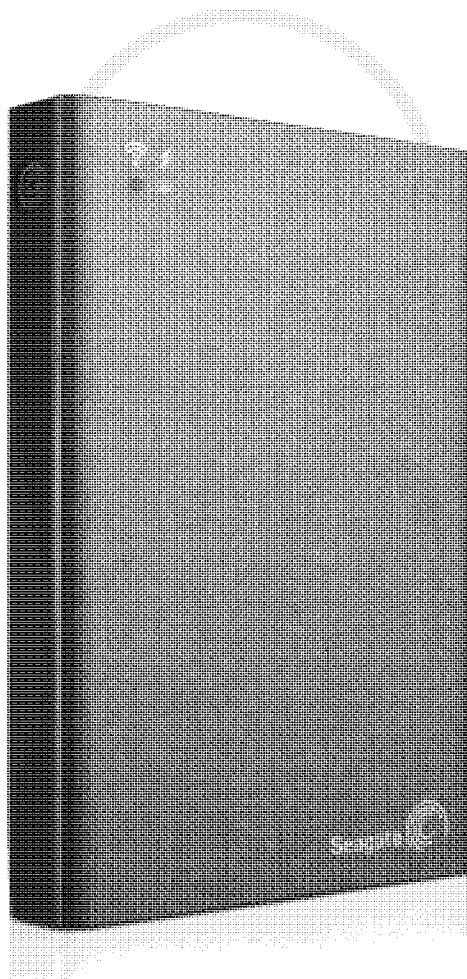
Seagate Technology LLC  
10200 South De Anza Boulevard  
Cupertino, California 95014  
408-658-1000

## Exhibit 25



# Storage Solutions Guide

APR 2013 | AMER



All this.

Organized here.

Accessible here.

Seagate Central  
**Get It  
Together.**  
Organize and access your digital life.



Storage for Life.



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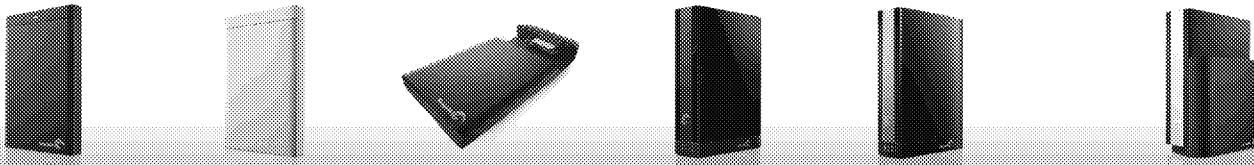
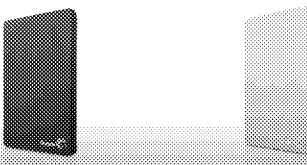

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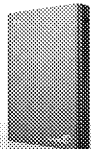



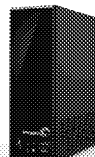
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# External Storage

## At-a-Glance Product Comparison

	BACKUP PLUS						SLIM		EXPANSION	
Direct Attached/ Portable										
	Backup Plus Portable	Backup Plus Portable for Mac	Thunderbolt™ Backup Plus for Mac Portable	Backup Plus Desktop	Backup Plus Desktop for Mac	Thunderbolt™ Backup Plus for Mac Desktop	Slim Portable	Slim Portable for Mac	Expansion Portable	Expansion Desktop
PERFECT FOR	Protecting and sharing digital memories			Keeping your digital life safe and sound		Keeping your digital life safe and sound	Thin storage that fits—and goes—anywhere		Protecting and sharing your digital life	
DESCRIPTION	Store and back up the content on your social networks with these flexible, portable drives. PC or Mac.			These desktop drives provide the simple, one-click way to protect and share files. PC or Mac.		These desktop drives provide the simple, one-click way to protect and share files. PC or Mac.	This ultra-thin metal design is the world's sleekest portable external hard drive. PC or Mac.		Expansion drives allow you to instantly add more storage space to your computer and take large files with you.	
LEARN MORE	Page 5	Page 6	Page 6	Page 8	Page 7	Page 7	Page 9	Page 8	Page 10	Page 9

Wireless Mobile		Network Attached				
	Wireless Plus		Central	Business Storage 4-Bay NAS	Business Storage 2-Bay NAS	Business Storage 1-Bay NAS
PERFECT FOR	Wireless storage for your tablet		PERFECT FOR		Centralized storage, collaboration and backup	
DESCRIPTION	Take your media library on the go and stream it wirelessly to your iPad, Android tablet and smartphone. PC or Mac.		DESCRIPTION		A complete network storage solution and private cloud for home offices.	
LEARN MORE	Page 10		LEARN MORE		Page 13	



# External Storage Solutions

Seagate external storage solutions are sleek, dependable and ultra-portable products that let your customers automatically and continuously store digital family photos, protect critical business data, back up multiple computers on a small network, or share and store videos and music.

## Backup Plus

The Backup Plus portable drive is the simple way to protect and share your entire digital life.

### Key Advantages

- Easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Thunderbolt technology or FireWire 800 upgrade allows higher transfer speeds

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.

CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBU1000100	USB 3.0	● Black	PC, Mac
1TB	STBU1000101	USB 3.0	● Silver	PC, Mac
1TB	STBU1000102	USB 3.0	● Blue	PC, Mac
1TB	STBU1000103	USB 3.0	● Red	PC, Mac
750GB	STBU750100	USB 3.0	● Black	PC, Mac
500GB	STBU500100	USB 3.0	● Black	PC, Mac
500GB	STBU500101	USB 3.0	● Silver	PC, Mac
500GB	STBU500102	USB 3.0	● Blue	PC, Mac
500GB	STBU500103	USB 3.0	● Red	PC, Mac
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.54-in D (132mm x 46mm x 166mm)			



<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.



## Backup Plus for Mac

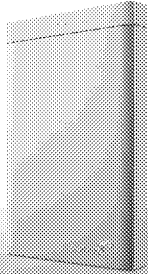
The Backup Plus portable drive for Mac is the simple way to protect and share your entire digital life.

### Key Advantages

- Mac OS and Time-Machine ready out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click.
- Easily increase transfer speeds by upgrading to Thunderbolt technology.

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBW1000301	USB 3.0	● Silver/ ○ White	Mac, PC
500GB	STBW500301	USB 3.0	● Silver/ ○ White	Mac, PC
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.54-in D (132mm x 46mm x 166mm)			

## Backup Plus Desktop for Mac

The Backup Plus desktop drive for Mac is the simple, one-click way to protect and share your entire digital life.

### Key Advantages

- Mac OS and Time Machine ready right out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click.
- Up to 3TB capacity for a lifetime of memories

### Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
3TB	STCB3000900	FireWire 800/ USB 3.0	● Black/ ● Silver	Mac, PC
2TB	STCB2000900	FireWire 800/ USB 3.0	● Black/ ● Silver	Mac, PC
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

## Thunderbolt™ Backup Plus for Mac Portable


The Thunderbolt Backup Plus for Mac portable drive is everything you need to transfer, store and back up files using Thunderbolt technology.

### Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Compatible with Time Machine software
- Compatible with Thunderbolt devices
- No external power supply required

### Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gbps



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBW1000401	Thunderbolt	● Black	Mac, PC
PRODUCT DIMENSIONS	5.12-in L x 3.19-in W x 1.09-in D (130mm x 81mm x 27.8mm)			
PACKAGE DIMENSIONS	6.69-in L x 5.24-in W x 1.81-in D (170mm x 133mm x 46mm)			

## Thunderbolt Backup Plus for Mac Desktop

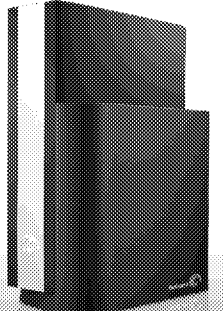
The Thunderbolt Backup Plus for Mac desktop drive is everything you need to transfer, store and back up files using Thunderbolt technology.

### Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Dual ports enable daisy-chaining up to six devices
- Compatible with Thunderbolt displays and other devices
- Compatible with Time Machine softwares

### Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gbps



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
3TB	STCB3000400	Thunderbolt	● Black	Mac, PC
PRODUCT DIMENSIONS	6.61-in L x 4.76-in W x 2.42-in D (168mm x 120.9mm x 61.4mm)			
PACKAGE DIMENSIONS	8.64-in L x 9.13-in W x 3.5-in D (219.5mm x 232mm x 89mm)			

# Backup Plus Desktop

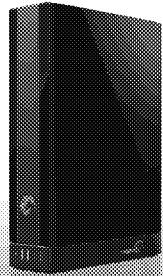
The Backup Plus desktop drive is the simple, one-click way to protect and share your entire digital life.

## Key Advantages

- Easy, flexible, built-in backup options
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Up to 4TB capacity for a lifetime of memories
- Increase transfer speeds by upgrading to Thunderbolt technology or FireWire 800.

## Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STCA4000100	USB 3.0	● Black	PC, Mac
3TB	STCA3000100	USB 3.0	● Black	PC, Mac
2TB	STCA2000100	USB 3.0	● Black	PC, Mac
1TB	STCA1000100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

# Slim

The Seagate Slim portable drive is thin, light and the easiest way yet to back up the things that are important to you.

## Key Advantages

- Just slightly thicker than an iPhone
- Protects your stuff with easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

## Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STCD500102	USB 3.0	● Black	PC, Mac
500GB	STCD500104	USB 3.0	● Silver	PC, Mac
PRODUCT DIMENSIONS	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
PACKAGE DIMENSIONS	5.59-in L x 1.22-in W x 4.06-in D (142mm x 31mm x 103mm)			

# Slim for Mac

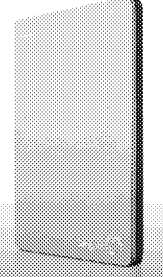
The Seagate Slim portable drive for Mac combines a thin, light form factor in a Time Machine-ready drive.

## Key Advantages

- Just slightly thicker than an iPhone
- Mac OS and Time Machine ready out of the box
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

## Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STCF500102	USB 3.0	● Silver	Mac, PC
PRODUCT DIMENSIONS	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
PACKAGE DIMENSIONS	5.59-in L x 1.22-in W x 4.06-in D (142mm x 31mm x 103mm)			

# Expansion

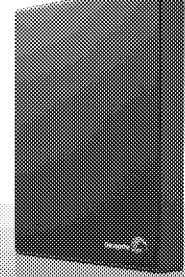
The Expansion desktop drive provides extra storage for your ever-growing collection of files.

## Key Advantages

- Simple and straightforward setup
- No software to install and nothing to configure
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

## Best-Fit Applications

- Instantly add more storage space to your computer.
- Improve performance on your computer's internal drive by freeing up space on your internal drive.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STBV4000100	USB 3.0	● Black	PC
3TB	STBV3000100	USB 3.0	● Black	PC
2TB	STBV2000100	USB 3.0	● Black	PC
1TB	STBV1000100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS	7.07-in L x 4.65-in W x 1.48-in D (179.5mm x 118mm x 37.5mm)			
PACKAGE DIMENSIONS	9.09-in L x 7.97-in W x 2.83-in D (231mm x 202mm x 72mm)			



## Expansion

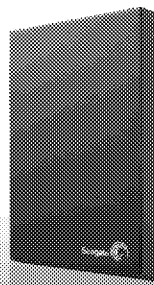
The Expansion portable drive is compact and perfect for taking large files with you on-the-go.

### Key Advantages

- Simple and straightforward setup
- Powered from the USB cable
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

### Best-Fit Applications

- Instantly add more storage space to your computer.
- Take large files with you when you travel.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBX1000101	USB 3.0	● Black	PC
750GB	STBX750100	USB 3.0	● Black	PC
500GB	STBX500100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS (1TB)	5.04-in L x 3.51-in W x 0.87-in D (128.1mm x 89.1mm x 22mm)			
PRODUCT DIMENSIONS (500GB)	4.81-in L x 3.19-in W x 0.61-in D (122.3mm x 81.1mm x 15.5mm)			
PACKAGE DIMENSIONS	5.28-in L x 6.69-in W x 1.89-in D (134mm x 170mm x 48mm)			

## Wireless Plus

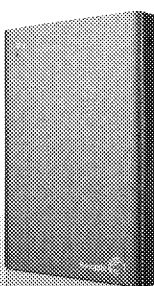
With Wireless Plus mobile device storage, you can take your media library with you. Stream it to your iPad or Android tablet.

### Key Advantages

- Take your media library with you on the go
- Stream media with up to 3 Wi-Fi enabled devices at the same time
- Use anywhere, without an Internet connection
- Up to 10 hours battery life<sup>3</sup>

### Best-Fit Applications

- Store and carry movies and other media on the go.
- Share media with others.
- Works with iPad or Android tablets and smartphones



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STCK1000100	USB 3.0	● Grey	PC, Mac
PRODUCT DIMENSIONS	5.00-in L x 3.50-in W x 0.78-in D (127mm x 89mm x 19.9mm)			
PACKAGE DIMENSIONS	2.00-in L x 6.02-in W x 7.16-in D (51mm x 153mm x 182mm)			

## Central

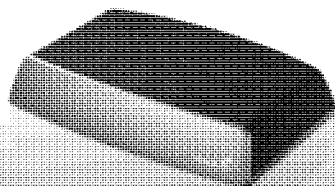
The Central shared network storage system allows you to create secure in-home cloud storage for multiple computers in the home.

### Key Advantages

- Automatically back up multiple PC and Mac computers
- Wirelessly stream your centralized media library to gaming consoles, media players and smart TVs
- Access content on-the-go with a Web browser or the free app for tablets and smartphones

### Best-Fit Applications

- Consolidate content on one easily accessible device
- Back up multiple PC and Mac computers
- Enjoy a centralized media library on smart TVs, game consoles and media players
- Access your content on-the-go with laptops and mobile devices
- Archive your Facebook photos and videos



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STCG4000100	SATA/GigE	● Black	PC, Mac
3TB	STCG3000100	SATA/GigE	● Black	PC, Mac
2TB	STCG2000100	SATA/GigE	● Black	PC, Mac
PRODUCT DIMENSIONS	5.7-in L x 8.5-in W x 1.7-in D (145mm x 216mm x 42mm)			
PACKAGE DIMENSIONS	3.15-in L x 10.3-in W x 9.25-in D (80mm x 261mm x 235mm)			



## Business Storage 4-Bay NAS

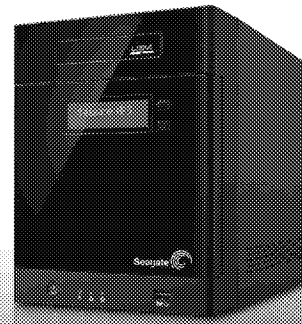
A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations

### Key Advantages

- Easy ten-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0, 1, 5 and 10 configuration options

### Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage
- Encrypt individual files to entire volumes of data
- Transport large files using external drives



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
16TB	STBP16000100	Gigabit Ethernet	● Black	PC, Mac
12TB	STBP12000100	Gigabit Ethernet	● Black	PC, Mac
8TB	STBP8000100	Gigabit Ethernet	● Black	PC, Mac
4TB	STBP4000100	Gigabit Ethernet	● Black	PC, Mac
—	STBP100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	6.3-in W x 8.2-in H x 10.2-in D (161.00mm x 208.00mm x 258.50mm)			
PACKAGE DIMENSIONS	9.4-in W x 14.9-in H x 9.4-in D (240.00mm x 379.00mm x 243.00mm)			

## Business Storage 2-Bay NAS

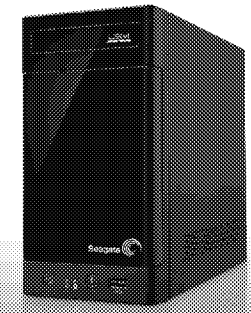
Create a private cloud to help protect your business-critical data and centralize files in a single location you can access from anywhere

### Key Advantages

- Easy ten-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0 and 1 configuration options

### Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
8TB	STBN8000100	Gigabit Ethernet	● Black	PC, Mac
6TB	STBN6000100	Gigabit Ethernet	● Black	PC, Mac
4TB	STBN4000100	Gigabit Ethernet	● Black	PC, Mac
—	STBN100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	4.1-in W x 8.0-in H x 8.9-in D (104.50mm x 204.00mm x 227.00mm)			
PACKAGE DIMENSIONS	6.2-in W x 10.9-in H x 12.5-in D (157.00mm x 277.00mm x 317.00mm)			

## Business Storage 1-Bay NAS

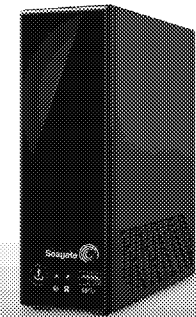
Create a private cloud with Seagate Business Storage 1-Bay NAS. It helps protect your all-important data and centralizes your files in a single location you can access from anywhere.

### Key Advantages

- Easy ten-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Stream your media library to networked computers, Internet TVs, game consoles and more

### Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage

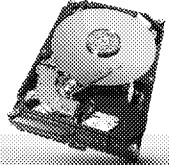
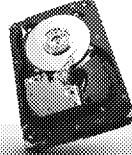


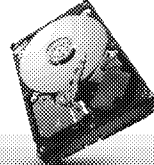




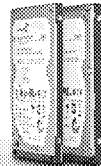


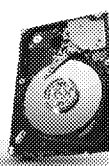
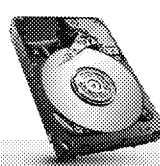

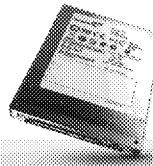
CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
4TB	STBM4000100	Gigabit Ethernet	● Black	PC, Mac
3TB	STBM3000100	Gigabit Ethernet	● Black	PC, Mac
2TB	STBM2000100	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	2.4-in W x 6.9-in H x 5.8-in D (61mm x 176mm x 148mm)			
PACKAGE DIMENSIONS	3.7-in W x 9.3-in H x 9.0-in D (93mm x 236mm x 229mm)			



# Internal Storage

## At-a-Glance Product Comparison

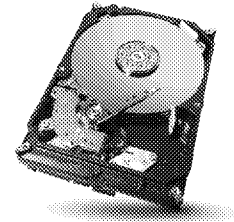
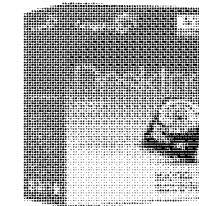
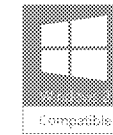
	DESKTOP	ENTERPRISE			VIDEO STORAGE		
3.5-inch							
	Desktop HDD	Cheetah® 15K	Enterprise Capacity 3.5 HDD	Enterprise Value HDD	SV35 Series™	Video 2.5 HDD	Pipeline HD®
BUSINESS NEED	Mainstream	Performance	Mainstream	Low Power	Surveillance	DVR	DVR
USE THIS DRIVE FOR	Desktop compute where choice in capacity and cache options to provide design flexibility is important	High-capacity, compute-intensive requirements demanding high performance and availability	Bulk-data applications requiring reliable, highest-capacity storage, efficiency and enterprise-class reliability	Cost-effective, low-power bulk storage solutions for unstructured data in clouds	Surveillance systems that require high performance, low-power and centralized storage for every surveillance application	Video streaming where 24x7 operation, small form factor and low power consumption are needed	DVR systems where reliable, low-power, purpose-built storage is required for video streaming applications
ENCRYPTION MODELS AVAILABLE		X	X				
LEARN MORE	Page 18	Page 29	Page 30	Page 32	Page 37	Page 36	Page 36

	LAPTOP			ENTERPRISE			ENTERPRISE SSD
2.5-inch							
	Laptop SSHD and Laptop Thin SSHD	Momentus	Momentus Thin	Savvio® 15K	Enterprise Performance 10K HDD	Constellation.2™	Pulsar.2™
BUSINESS NEED	Performance	Mainstream	Thin (7mm z-ht.)	Performance	Mainstream	Low Power	Mainstream
USE THIS DRIVE FOR	The ultimate mobile computing experience, with SSD-like performance for all applications and OS environments	Laptop PCs where the lowest power consumption, silent acoustics and the highest quality is always expected	Slim computing devices such as thin laptops and netbooks, where z-height makes all the difference	Compute-intensive data requirements demanding the highest performance density and availability	Mainstream data requiring high capacity, performance density and reliability	Online reference data demands requiring cost-effective, low-power, enterprise-class drives	Enterprise environments requiring MLC-enabled, high-capacity SSD with data integrity and drive endurance
ENCRYPTION MODELS AVAILABLE		X	X	X	X	X	X
LEARN MORE	Page 22	Page 23	Page 24	Page 29	Page 28	Page 31	Page 33

# Desktop Storage Solutions

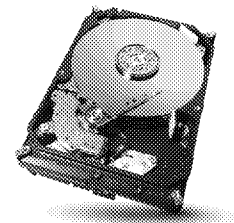
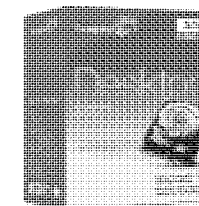
Seagate has a distinguished history in consistently delivering innovative technologies, super-sized capacities, low power and blazing-fast performance. Seagate desktop drives offer excellent performance at all levels.

## Product Comparison



	DESKTOP 3.5-INCH INTERNAL KIT	DESKTOP HDD
Application	Mainstream	Mainstream and Performance
Description	The fast, powerful and easy way to upgrade or add storage capacity to desktop computers	Tuned performance for low-power, mainstream and high-performance desktop computing
Form Factor	3.5 inch	3.5 inch
Reliability (AFR)	<1%	<1%
Max. Ext. Transfer Rate	300MB/s to 600MB/s	600MB/s
Capacity <sup>1</sup>	500GB to 3TB	250GB to 4TB
Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 6Gb/s
Cache	16MB to 64MB	16MB to 64MB
Power (Idle)		4.0W to 5.8W

## Feature Comparison



	MAINSTREAM	MAINSTREAM AND PERFORMANCE
Product	Desktop 3.5-Inch Internal Kit	Desktop HDD
SATA Interface	X	X
Sustainable Technology	X	X
Best-in-Class Performance		X
Capacity Leadership	X	X
Quiet Acoustics	X	
DiscWizard™ Installation Software	X	X
Compatible with Windows 8 <sup>2</sup>	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 8, visit <http://www.seagate.com/en-us/windows/compatibility/windows/compatcenter/home>



# Desktop HDD

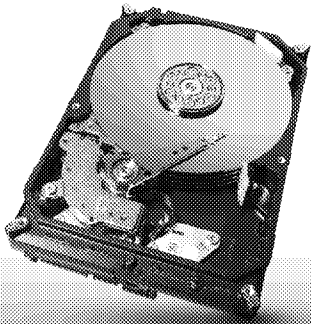
Seagate Desktop HDDs give you the Power of One with 1TB-per-disk technology and one drive platform for every capacity and application.

## Key Advantages

- Up to 4TB capacity
- AcuTrac™ and OptiCache™ technologies deliver dependable overall performance.
- Seagate SmartAlign™ technology provides simple migration to Advanced Format 4K sectors.
- Free Seagate DiscWizard™ software

## Best-Fit Applications

- Desktop or all-in-one PCs and home servers
- PC-based gaming systems
- Desktop RAID
- Direct-attached external storage devices (DAS)



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000DM000	SATA 6Gb/s NCQ	64MB
3TB	ST3000DM001	SATA 6Gb/s NCQ	64MB
2TB	ST2000DM001	SATA 6Gb/s NCQ	64MB
1TB	ST1000DM003	SATA 6Gb/s NCQ	64MB
500GB	ST500DM002	SATA 6Gb/s NCQ	16MB
320GB	ST320DM000	SATA 6Gb/s NCQ	16MB
250GB	ST250DM000	SATA 6Gb/s NCQ	16MB

# Desktop 3.5-Inch Internal Kit

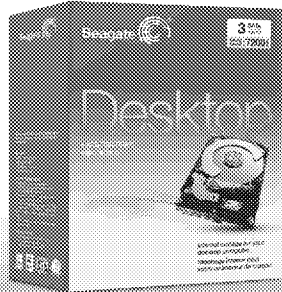
Seagate 3.5-inch internal drives are the fast, powerful, and easy way to upgrade or add storage capacity to desktop computers.

## Key Advantages

- Quiet, ultra-high performance
- DiscWizard™ software makes installation a snap
- Built-in self-monitoring technology helps ensure maximum reliability

## Best-Fit Applications

- Gaming PCs
- Workstations
- High-end PCs
- Desktop RAID
- Mainstream/office PCs



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	CACHE
4TB	STBD4000400	SATA 6Gb/s	64MB
3TB	STBD3000100	SATA 6Gb/s	64MB
2TB	STBD2000101	SATA 6Gb/s	64MB
1TB	ST310005N1A1AS-RK	SATA 6Gb/s	64MB
500GB	ST3500641AS-RK	SATA 3Gb/s	64MB
PACKAGE DIMENSIONS	7.38-in L x 5.88-in W x 2.88-in D (187mm x 149mm x 73mm)		



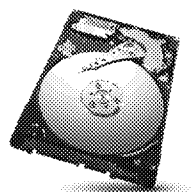
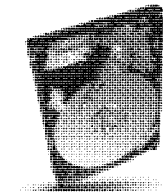
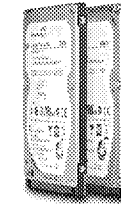
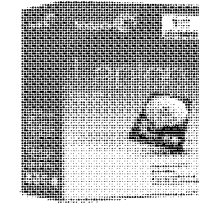
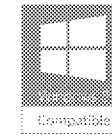
<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity  
<sup>2</sup> U.S. model numbers shown



# Laptop Storage Solutions

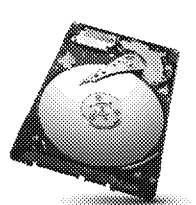
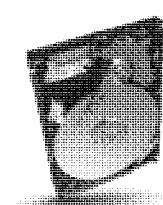
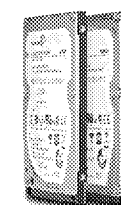
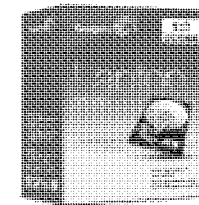
Seagate laptop drives address every mobile market need, delivering superior performance, reliability and value. Feature-rich with innovative options, the Seagate laptop lineup also includes self-encryption and FIPS 140-2 validated models.

## Product Comparison



	LAPTOP 2.5-INCH INTERNAL KIT	LAPTOP SSHD AND LAPTOP THIN SSHD	MOMENTUS	MOMENTUS THIN
Application	Mainstream and Performance	Extreme Performance	Mainstream	Slim Computing
Description	A complete upgrade kit to transform your system to high performance or just add capacity	Solid state hybrid drives deliver SSD-like performance without sacrificing capacity	The best combination of capacity, mobility and durability in a laptop hard drive	The world's thinnest 2.5-inch drive for slim laptops and netbooks
Form Factor	2.5 inch	2.5 inch	2.5 inch	7mm, 2.5 inch
Reliability (AFR)	0.40% to 0.50%	0.48%	0.48%	0.48%
Max. Ext. Transfer Rate	300MB/s to 600MB/s	300MB/s to 600MB/s	300MB/s	300MB/s
Capacity <sup>1</sup>	250GB to 1TB	500GB and 1TB	250GB to 750GB	250GB to 500GB
Interface	SATA 6Gb/s	SATA 6Gb/s	SATA 3Gb/s	SATA 3Gb/s
Cache	8MB to 32MB	64MB	8MB to 16MB	16MB
Power (idle)		0.8W to 1.1W	0.67W to 0.81W	0.45W to 0.66W

## Feature Comparison



	MAINSTREAM AND PERFORMANCE	EXTREME PERFORMANCE	MAINSTREAM	SLIM COMPUTING
Product	Laptop 2.5-Inch Internal Kit	Laptop SSHD and Laptop Thin SSHD	Momentus	Momentus Thin
SATA Interface	X	X	X	X
Lowest Acoustics			X	X
Lowest Power			X	X
Self-Encrypting Drive				X
Drop Sensor Options			X	
Solid State Hybrid	X	X		
Compatible with Windows 8 <sup>2</sup>	X		X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 8, visit <http://www.seagate.com/en-us/windows/compatibility/windows/compatcenter/home>

# Laptop SSHD and Laptop Thin SSHD

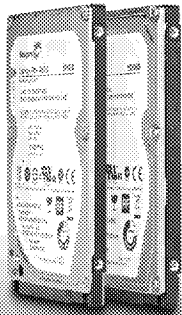
The Seagate Laptop SSHD (1TB) and Laptop Thin SSHD (500GB) enable laptop PC users to enjoy solid state performance without sacrificing capacity.

## Key Advantages

- Boots and performs like an SSD<sup>5</sup>
- Up to 4x faster than a traditional HDD<sup>5</sup>
- SATA 6Gb/s with NCQ for interface speed
- All-in-one design for simplicity and ease of installation
- Works in any laptop or PC, any OS and any application
- Backed by a 3-year limited warranty

## Best-Fit Applications

- Laptops and mobile workstations
- Desktop and tower workstations
- High-performance laptop and desktop gaming systems
- Small form factor all-in-one PCs



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
1TB	ST1000LM014	SATA 6Gb/s	64MB
500GB	ST500LM000	SATA 3Gb/s	64MB

# Momentus<sup>®</sup>

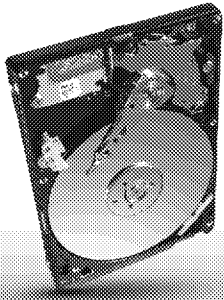
The Seagate Momentus drive offers the world's most feature-rich 2.5-inch family of storage for laptops and external enclosures.

## Key Advantages

- Innovative options and features—the power to transform from ordinary to extraordinary
- 7200 RPM delivers a constant high-performance boost.
- 5400 RPM enables affordable, low-power and high-capacity drives for external enclosures.
- G-Force Protection™ technology can help keep your data recoverable after a fall, even if your laptop doesn't survive.
- Seagate SmartAlign™ technology provides a transition to 4K sectors without the need for software utilities.

## Best-Fit Applications

- Mainstream and high-performance laptops
- External storage solutions, boxes
- Industrial applications requiring a small form factor



CAPACITY <sup>1</sup>	7200-RPM MODEL	INTERFACE	CACHE
750GB	ST9750420AS <sup>2</sup>	SATA 3Gb/s	16MB
500GB	ST9500423AS <sup>3</sup>	SATA 3Gb/s	16MB
320GB	ST320LT023 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250410AS	SATA 3Gb/s	16MB

CAPACITY <sup>1</sup>	5400-RPM MODEL	INTERFACE	CACHE
500GB	ST9500325AS	SATA 3Gb/s	8MB
500GB	ST9500325ASG <sup>2</sup>	SATA 3Gb/s	8MB
320GB	ST9320325AS	SATA 3Gb/s	8MB
250GB	ST9250315AS	SATA 3Gb/s	8MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Drive with G-Force Protection™ feature.  
<sup>3</sup> Advanced Format (4K) drive with SmartAlign™ technology resolves misalignment conditions.  
<sup>4</sup> 7mm 2.5-height expanded to 9.5mm enables compatibility with standard laptop chassis.  
<sup>5</sup> Performance may vary depending on user's hardware configuration and operating system. Testing performed on a Laptop SSHD 1TB and a Laptop Thin SSHD 500GB.

## Momentum® Thin

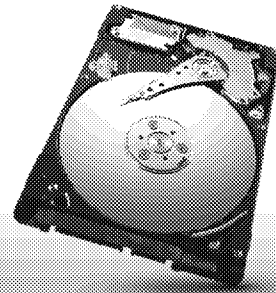
The 7mm, 2.5-inch drive enables slim computing for all types of mobile computing, from laptops to netbooks to smaller desktop PCs.

### Key Advantages

- 7mm z-height form factor enables thin chassis design for all segments of laptop computing.
- Seagate SmartAlign™ technology provides a transition to 4K sectors without the need for software utilities.
- Self-Encrypting Drive options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification<sup>3</sup> are government-approved for the U.S. and Canadian governments.

### Best-Fit Applications

- Thin entry-level laptop PCs
- Thin high-end netbooks
- Thin ultraportables



CAPACITY <sup>1</sup>	7200-RPM MODEL	INTERFACE	CACHE
320GB	ST320LT007	SATA 3Gb/s	16MB
320GB	ST320LT014 <sup>2</sup>	SATA 3Gb/s	16MB
320GB	ST320LT009 <sup>2,3</sup>	SATA 3Gb/s	16MB
250GB	ST250LT007	SATA 3Gb/s	16MB
250GB	ST250LT014 <sup>2</sup>	SATA 3Gb/s	16MB
250GB	ST250LT009 <sup>2,3</sup>	SATA 3Gb/s	16MB

CAPACITY <sup>1</sup>	5400-RPM MODEL	INTERFACE	CACHE
500GB	ST500LT025 <sup>2,4</sup>	SATA 3Gb/s	16MB
500GB	ST500LT015 <sup>3,4</sup>	SATA 3Gb/s	16MB
500GB	ST500LT012	SATA 3Gb/s	16MB
320GB	ST320LT020	SATA 3Gb/s	16MB
320GB	ST320LT012 <sup>1</sup>	SATA 3Gb/s	16MB
250GB	ST250LT003	SATA 3Gb/s	16MB
250GB	ST250LT012 <sup>1</sup>	SATA 3Gb/s	16MB

## Laptop 2.5-Inch Internal Kit

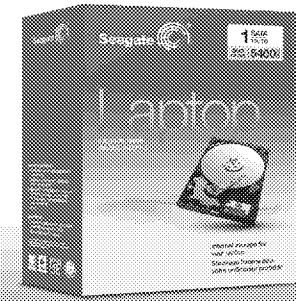
Seagate 2.5-inch internal drives deliver vast amounts of storage for adding capacity or upgrading drives in laptop computers.

### Key Advantages

- Built for mobility
- Preserves battery life
- Large data cache
- Outstanding performance
- Laptop solid state hybrid model offers SSD-like performance with the capacity of a hard drive.

### Best-Fit Applications

- Replacement laptop drives
- Laptop storage upgrades
- High-end laptops and workstations



CAPACITY <sup>1</sup>	KIT NUMBER <sup>5</sup>	INTERFACE	CACHE
1TB	STBD1000100	SATA 3Gb/s	8MB
500GB	ST905003N3A1AS-RK	SATA 3Gb/s	16MB
500GB	ST905003N1A1AS-RK	SATA 3Gb/s	8MB
250GB	ST90250N1A1AS-RK	SATA 3Gb/s	8MB
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		



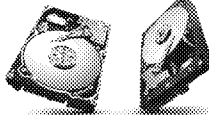
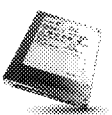
LAPTOP SSD MODEL			
CAPACITY <sup>1</sup>	KIT NUMBER <sup>5</sup>	INTERFACE	MLC FLASH
1TB	STBD1000400	SATA 6Gb/s	8GB
500GB	STBD750100	SATA 6Gb/s	8GB
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		





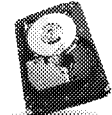

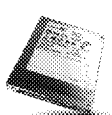
# Enterprise Storage Solutions

Seagate has the enterprise storage expertise as well as the global presence, processes and resources to consistently support small or medium businesses and run a large data center with the industry's highest-quality enterprise storage products, including FIPS 140-2 validated security-minded models.

## Product Comparison

				
	ENTERPRISE PERFORMANCE HDD	CHEETAH®	ENTERPRISE CAPACITY HDD	PULSAR®
Application	SFF Performance and Mainstream	LFF Performance	High Capacity and Low Power	Mainstream SSD
Description	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 2.5-inch form factor	Highest-performing, highly reliable 15K-RPM enterprise hard drives in a 3.5-inch form factor	High-capacity, lowest-power, reliable 7200-RPM enterprise hard drive in both 2.5- and 3.5-inch form factors	Performance, data integrity and drive endurance in an enterprise solid state drive
Form Factor	2.5-inch	3.5-inch	2.5-inch and 3.5-inch	2.5-inch
Reliability (AFR)	0.44%	0.55%	0.62% and 1.095%	0.44%
Capacity <sup>1</sup>	300GB to 900GB	300GB to 600GB	250GB to 4TB	100GB to 800GB
Power (Idle)	3.0W to 4.4W	8.74W to 11.68W	2.52W to 7.7W	3.47W to 5.92W
Interface	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, SATA 6Gb/s	6Gb/s SAS, SATA 6Gb/s
Limited Warranty <sup>4</sup>	5 years	5 years	3 years and 5 years	5 years

## Feature Comparison

						
	2.5-Inch Mission Critical	3.5-Inch Mission Critical	2.5-Inch Nearline	3.5-Inch Nearline	Mainstream SSD	
Product	Savvio 15K	Enterprise Performance 10K HDD	Cheetah 15K	Constellation	Enterprise Capacity 3.5 HDD Enterprise Value HDD	Pulsar.2
Best-in-Class Performance	X	X	X	X	X	
Capacity Leadership		X	X		X	X
Vibration Tolerance for Multi-Drive Stabilization	X	X	X	X	X	
6Gb/s SAS Interface	X	X	X	X	X	X
4Gb/s FC Interface		X	X			
6Gb/s SATA Interface				X	X	X
Best-in-Class Power Usage		X		X	X	
PowerChoice™ Optimized Idle Power Settings		X		X	X	
Self-Encrypting Drive (SED) <sup>2</sup>	X	X	X	X	X	X
FIPS 140-2 SED <sup>2,3</sup>	X	X	X	X	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes, and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/scvp/documents/140-1/1401vend.htm>.  
<sup>4</sup> Warranty terms may vary based on usage. Consult your Seagate sales representative for warranty terms and conditions.

## Enterprise Performance 10K HDD

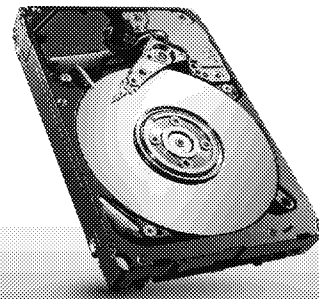
Seagate Enterprise Performance 10K HDDs deliver the optimal balance of capacity, performance and power in a 10K-RPM, 2.5-inch enterprise drive.

### Key Advantages

- Highest-capacity enterprise SFF hard drive (up to 900GB)
- PowerChoice™ technology reduces power consumption.
- First SFF 10K-RPM drive to support 4Gb/s FC
- Protection Information (PI) option detects corruption of data in flight between the host system and the drive<sup>5</sup>
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Mission-critical servers and external storage arrays
- Power- and space-constrained data centers
- Compliance or data security initiatives



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
900GB	ST900MM0026 <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST900MM0036 <sup>2,4</sup>	6Gb/s SAS	64MB
900GB	ST9900805SS	6Gb/s SAS	64MB
900GB	ST9900705SS <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST9900605SS <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST9900805FC	4Gb/s FC	64MB
600GB	ST600MM0026 <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600205SS	6Gb/s SAS	64MB
600GB	ST9600105SS <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600005SS <sup>2,3</sup>	6Gb/s SAS	64MB
600GB	ST9600205FC	4Gb/s FC	64MB
450GB	ST450MM0026 <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450405SS	6Gb/s SAS	64MB
450GB	ST9450305SS <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450205SS <sup>2,3</sup>	6Gb/s SAS	64MB
450GB	ST9450405FC	4Gb/s FC	64MB
300GB	ST300MM0026 <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300605SS	6Gb/s SAS	64MB
300GB	ST9300505SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300405SS <sup>2,3</sup>	6Gb/s SAS	64MB
300GB	ST9300605FC	4Gb/s FC	64MB

## Savvio® 15K

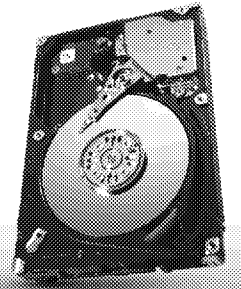
The 2.5-inch Seagate Savvio 15K hard drive provides the world's highest performance and reliability while delivering ultra-low power consumption.

### Key Advantages

- Stores twice the amount of Tier 1 data without increasing drive count
- Enables Tier 1 applications to process transactions more quickly
- Reduces system complexity and operating costs
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- High-performance enterprise servers and storage arrays
- Transaction-intensive database applications
- Blade, rack and tower servers
- Security compliance-driven IT organizations



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
300GB	ST9300653SS	6Gb/s SAS	64MB
300GB	ST930053SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300453SS <sup>2,3</sup>	6Gb/s SAS	64MB
146GB	ST9146853SS	6Gb/s SAS	64MB
146GB	ST9146753SS <sup>2</sup>	6Gb/s SAS	64MB
146GB	ST9146653SS <sup>2,3</sup>	6Gb/s SAS	64MB
146GB	ST9146852SS	6Gb/s SAS	16MB
146GB	ST9146752SS <sup>2</sup>	6Gb/s SAS	16MB
146GB	ST9146652SS <sup>2,3</sup>	6Gb/s SAS	16MB
73GB	ST973452SS	6Gb/s SAS	16MB
73GB	ST973352SS <sup>2</sup>	6Gb/s SAS	16MB
73GB	ST973252SS <sup>2,3</sup>	6Gb/s SAS	16MB

## Cheetah® 15K

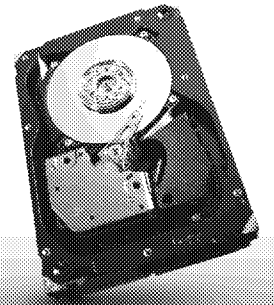
The Seagate Cheetah 15K drive provides the highest capacity, performance and reliability in 3.5-inch mission-critical storage.

### Key Advantages

- Third-generation perpendicular recording
- Sustained data rate of up to 204MB/s
- Industry's highest 3.5-inch drive reliability
- Powertrim™ technology optimizes power consumption
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Business and transaction processing
- Email and decision support
- Storage Area Networks (SAN)
- Network Attached Storage (NAS)
- Internet and e-commerce



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
600GB	ST3600057SS	6Gb/s SAS	16MB
600GB	ST3600957SS <sup>2</sup>	6Gb/s SAS	16MB
600GB	ST3600857SS <sup>2,3</sup>	6Gb/s SAS	16MB
600GB	ST3600057FC	4Gb/s FC	16MB
450GB	ST3450857SS	6Gb/s SAS	16MB
450GB	ST3450757SS <sup>2</sup>	6Gb/s SAS	16MB
450GB	ST3450657SS <sup>2,3</sup>	6Gb/s SAS	16MB
450GB	ST3450857FC	4Gb/s FC	16MB
300GB	ST3300657SS	6Gb/s SAS	16MB
300GB	ST3300557SS <sup>2</sup>	6Gb/s SAS	16MB
300GB	ST3300457SS <sup>2,3</sup>	6Gb/s SAS	16MB
300GB	ST3300657FC	4Gb/s FC	16MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/ST/tm/cnmp/documents/140-1/1401vend.html>.  
<sup>4</sup> FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/ST/tm/cnmp/validation.html#F05>.  
<sup>5</sup> Protection Information (PI) feature requires PI-compliant host or controller support.



# Enterprise Capacity 3.5 HDD

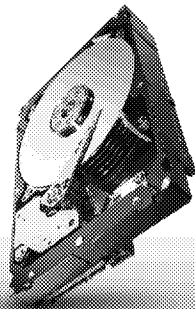
The Seagate Enterprise Capacity 3.5 HDDs help data centers meet the demanding growth of unstructured data.

## Key Advantages

- Highest-capacity enterprise drive for maximum density server and storage solutions
- SAS and SATA interfaces with 24x7 reliability
- Predictable 7200-RPM performance even in the most rugged multi-drive environments
- Improved power and cooling efficiencies with low power consumption and on-demand PowerChoice™ technology
- Protect your data and ease data disposal costs and management with the SED FIPS 140-2 option.<sup>2,3</sup>

## Best-Fit Applications

- High-capacity RAID storage
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
4TB	ST4000NM0033	SATA 6Gb/s	128MB
4TB	ST4000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
4TB	ST4000NM0073 <sup>2,3</sup>	SATA 6Gb/s	128MB
4TB	ST4000NM0023	6Gb/s SAS	128MB
4TB	ST4000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
4TB	ST4000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB
3TB	ST3000NM0033	SATA 6Gb/s	128MB
3TB	ST3000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
3TB	ST3000NM0023	6Gb/s SAS	128MB
3TB	ST3000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
3TB	ST3000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB
2TB	ST2000NM0033	SATA 6Gb/s	128MB
2TB	ST2000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
2TB	ST2000NM0023	6Gb/s SAS	128MB
2TB	ST2000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
2TB	ST2000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB
1TB	ST1000NM0033	SATA 6Gb/s	128MB
1TB	ST1000NM0053 <sup>2</sup>	SATA 6Gb/s	128MB
1TB	ST1000NM0023	6Gb/s SAS	128MB
1TB	ST1000NM0043 <sup>2</sup>	6Gb/s SAS	128MB
1TB	ST1000NM0063 <sup>2,3</sup>	6Gb/s SAS	128MB

# Enterprise Value HDD

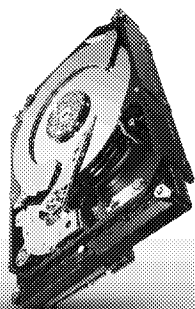
The Seagate Enterprise Value HDD is designed for vast amounts of unstructured data in the cloud.

## Key Advantages

- Affordable storage for 24x7 cloud data center replicated environments
- High vibration tolerance for reliable performance
- Save on power and cooling costs with the lowest 3.5-inch enterprise drive operating power.
- Advanced format logical block management
- Lower TCO with Seagate Instant Secure Erase
- Maximize your cloud storage with up to 114TB per square foot.<sup>4</sup>

## Best-Fit Applications

- Cloud storage servers and arrays
- Cloud backup storage
- Direct-attached external storage devices (DAS)
- Network-attached storage devices (NAS)



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
3TB	ST3000NC002	SATA 6Gb/s	64MB <sup>3</sup>
3TB	ST3000NC000 <sup>2</sup>	SATA 6Gb/s	64MB <sup>3</sup>
2TB	ST2000NC001	SATA 6Gb/s	64MB <sup>3</sup>
2TB	ST2000NC000 <sup>2</sup>	SATA 6Gb/s	64MB <sup>3</sup>
1TB	ST1000NC001	SATA 6Gb/s	64MB <sup>3</sup>
1TB	ST1000NC000 <sup>2</sup>	SATA 6Gb/s	64MB <sup>3</sup>



<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drives (SED) and FIPS 140-2 Validated drives are not available in all models or countries.  
<sup>3</sup> May require TCG-compliant host or controller support.  
<sup>4</sup> FIPS 140-2 in review. See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cmvp/documents/140-1/1401val2011.htm#1635>

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/cmvp/documents/140-1/1401val2011.htm#1635>.  
<sup>4</sup> Based on maximum use of multiple 3.5-inch HDDs in standard 42U 19-inch rack.

## Constellation.2™

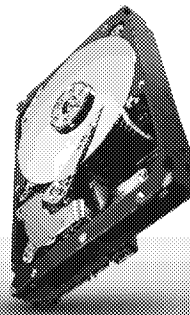
The Seagate Constellation.2 drive is the only 2.5-inch enterprise-class hard drive delivering both 1TB capacities and enterprise reliability.

### Key Advantages

- Maximizes data center footprint with up to 76TB/sq.ft.
- Energy-efficient storage at under 3.9W (idle)
- Highest nearline reliability with an MTBF of 1.4M hours
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data.
- FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- Storage-hungry business applications
- Storage area networks and network attached storage
- Maximum-capacity servers and blade servers
- Rich media content storage
- Enterprise backup and restore—D2D, virtual tape
- Cloud computing



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
1TB	ST91000640NS	SATA 6Gb/s	64MB
1TB	ST91000641NS <sup>2</sup>	SATA 6Gb/s	64MB
1TB	ST91000642NS <sup>2,3</sup>	SATA 6Gb/s	64MB
1TB	ST91000640SS	6Gb/s SAS	64MB
1TB	ST91000641SS <sup>2</sup>	6Gb/s SAS	64MB
1TB	ST91000642SS <sup>2,3</sup>	6Gb/s SAS	64MB
500GB	ST9500620NS	SATA 6Gb/s	64MB
500GB	ST9500621NS <sup>2</sup>	SATA 6Gb/s	64MB
500GB	ST9500622NS <sup>2,3</sup>	SATA 6Gb/s	64MB
500GB	ST9500620SS	6Gb/s SAS	64MB
500GB	ST9500621SS <sup>2</sup>	6Gb/s SAS	64MB
500GB	ST9500622SS <sup>2,3</sup>	6Gb/s SAS	64MB
250GB	ST9250610NS	SATA 6Gb/s	64MB
250GB	ST9250611NS <sup>2</sup>	SATA 6Gb/s	64MB
250GB	ST9250612NS <sup>2,3</sup>	SATA 6Gb/s	64MB

## Pulsar.2™

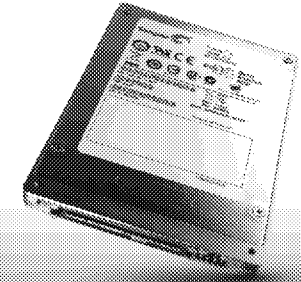
The Seagate Pulsar.2 drive delivers the price-performance, data integrity and endurance benefits for performance-hungry enterprise applications.

### Key Advantages

- Best-in-class MLC endurance (up to 10 full drive writes/day)
- Price-performance and reliability benefits
- Protects against unintended data change or loss—ensuring data integrity
- Provides the same feature set to look, feel and act like an enterprise hard drive—reducing system complexity and operating costs

### Best-Fit Applications

- Tier 0, performance-hungry enterprise applications—virtualization, OLTP, data warehousing and cloud computing
- Blade servers, general servers and direct-attached storage
- Enterprise architectures using auto-tiering



CAPACITY <sup>1</sup>	MODEL	INTERFACE	FULL DRIVE WRITES/DAY <sup>4</sup>
800GB	ST800FM0002	6Gb/s SAS	10
800GB	ST800FM0012 <sup>2</sup>	6Gb/s SAS	10
400GB	ST400FM0002	6Gb/s SAS	10
400GB	ST400FM0012	SATA 6Gb/s	10
200GB	ST200FM0002	6Gb/s SAS	10
200GB	ST200FM0012	SATA 6Gb/s	10
100GB	ST100FM0002	6Gb/s SAS	10
100GB	ST100FM0012	SATA 6Gb/s	10

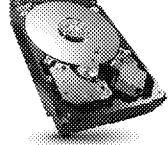
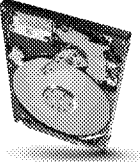
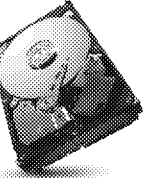


# Video Storage Solutions

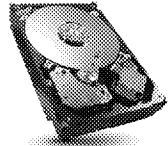


## Storage solutions for DVRs and surveillance systems

Seagate has the global presence to provide the supply and support for CE integrators as well as a complete business and technology partnership for the video storage market.

## Product Comparison

			
	PIPELINE HD®	VIDEO 2.5 HDD	SV35 SERIES™
Application	Mainstream CE-DVR	Small form factor CE-DVR	Video Surveillance
Description	Cool, quiet, low-power performance—perfect for high-definition consumer DVR applications	Cool, quiet, low power—perfect for small form factor and power-sensitive designs	Optimized performance, power savings and improved reliability for video surveillance applications
Form Factor	3.5-inch	3.5-inch	3.5-inch
Simultaneous HD Streams Supported	up to 16	up to 12	—
Reliability (AFR)	0.55%	0.55%	<1%
Max. Ext. Transfer Rate	300MB/s to 600MB/s	300MB/s	600MB/s
Capacity <sup>1</sup>	250GB to 2TB	250GB to 500GB	1TB to 3TB
Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 3Gb/s	SATA 6Gb/s
Cache	8MB to 64MB	16MB	64MB
Power (Idle)	2.5W to 4.5W	0.66W	3.36W to 5.4W (Idle2)

## Feature Comparison

			
	3.5-Inch CE-DVR	2.5-Inch CE-DVR	Video Surveillance
Application	Pipeline HD	Video 2.5 HDD	SV35 Series
SATA Interface	x	x	x
Low Power	x	x	
Quiet Acoustics	x	x	
Cool Operation	x	x	x
Sustainable Technology	x	x	
Best-in-Class Performance	x	x	x
Capacity Leadership	x	x	
24x7 Operation Capable	x	x	x
Extremely Low Vibration	x	x	

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

## Pipeline HD®

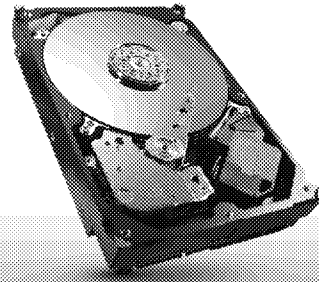
Seagate Pipeline HD drives deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

### Key Advantages

- Virtually silent streaming performance as low as 19dB
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

### Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
2TB	ST2000VM003	SATA 6Gb/s	64MB
1TB	ST1000VM002	SATA 6Gb/s	64MB
500GB	ST3500312CS	SATA 3Gb/s	8MB
320GB	ST3320311CS	SATA 3Gb/s	8MB
250GB	ST3250312CS	SATA 3Gb/s	8MB

## Video 2.5 HDD

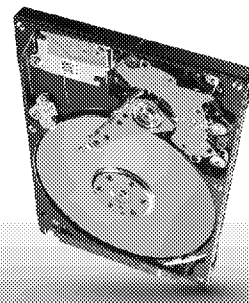
Seagate Video 2.5 HDDs let you stream, record and play back your video content with unparalleled reliability and performance.

### Key Advantages

- Virtually silent streaming performance as low as 19dB
- Built for 24x7 operation and low power consumption
- Small form factor allows system cost reduction and operational power savings
- Fanless design allows flexibility in a sleek system design.
- 0.55% AFR supports longevity in demanding consumer electronic environments.

### Best-Fit Applications

- DVR and media center applications
- Home theater PCs
- Karaoke and audio jukeboxes
- Cable, satellite and IPTV set-top boxes
- In-camera or surveillance systems



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
500GB	ST500VT000	SATA 3Gb/s	16MB
320GB	ST320VT000	SATA 3Gb/s	16MB
250GB	ST250VT000	SATA 3Gb/s	16MB

## SV35 Series™

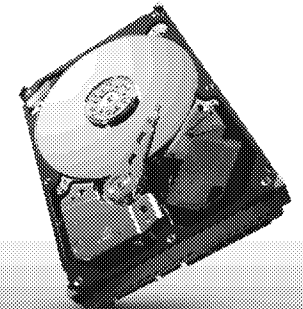
The Seagate SV35 series drives optimize performance, save power and improve reliability for video surveillance applications.

### Key Advantages

- Higher areal density for cost-effective DVR applications
- Performance-tuned for seamless video applications
- Enterprise-class reliability for 24x7 video surveillance applications
- Built-in error recovery for non-stop streaming

### Best-Fit Applications

- Video surveillance digital video recorder
- Video surveillance network digital video recorder
- Direct-attached JBOD video surveillance storage
- Network-attached JBOD video storage



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
3TB	ST3000VX000	SATA 6Gb/s	64MB
2TB	ST2000VX000	SATA 6Gb/s	64MB
1TB	ST1000VX000	SATA 6Gb/s	64MB

## Partner Resources and Benefits

The Seagate Partner Program (SPP) provides access to unique resources and benefits to help channel partners secure new opportunities and grow revenue and profitability.

As a registered SPP member, you enjoy the following exclusive features:

- Password-protected portal
- E-newsletter and regular news updates
- New product evaluation unit program
- Training and sales tools
- Priority support

**Start reaping the rewards of SPP membership—register today at [www.seagate.com/www/partners](http://www.seagate.com/www/partners)**

- Complete the online form.
- Click through and accept our standard agreement.

 **Partner Program**

## Service and Support

For information regarding products and services, visit [www.seagate.com/about/contact-us/technical-support](http://www.seagate.com/about/contact-us/technical-support)

### Available services include:

- Presales and Technical Support
- Global Support Services telephone numbers and business hours
- Authorized Seagate Service Centers

For information regarding Warranty Support, visit [www.seagate.com/support/warranty-and-returns](http://www.seagate.com/support/warranty-and-returns)

For information regarding Data Recovery Services, visit [www.seagate.com/services-software/](http://www.seagate.com/services-software/)

For Seagate OEM and Distribution partner portal, visit [www.seagate.com/www/partners](http://www.seagate.com/www/partners)

For Seagate reseller portal, visit [www.seagate.com/www/partners](http://www.seagate.com/www/partners)



**Seagate Technology LLC**  
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Cupertino, California 95014  
408-658-1000

## Exhibit 26





# Storage Solutions Guide

MAY 2012 | AMER



# The Best Storage Solutions Are Here

This guide offers up-to-date details and specifications for all Seagate® products. From the world's fastest, largest-capacity desktop drives to external storage solutions that allow you to access your files anytime, anywhere.



[www.seagate.com](http://www.seagate.com)

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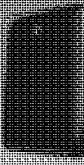
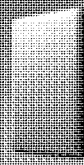
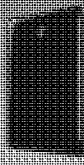
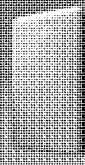
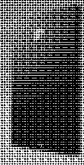
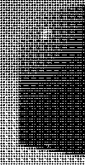
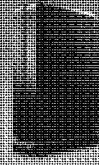
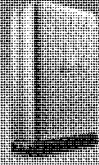


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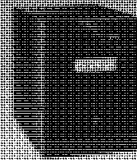

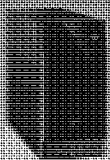
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# External Storage

## At-a-Glance Product Comparison

Direct Attached/ Portable	GOFLEX™								EXPANSION™	
										
PERFECT FOR	Compact storage on the go				Sleek, high-performance storage		Sleek, high-performance storage		Satisfying high-capacity cravings	
DESCRIPTION	These ultra-portable, ultra-upgradable drives make it easy to store and protect all your files, automatically and continuously. PC or Mac.				A sleek, anodized design with 7200-RPM performance, this is the slimmest portable hard drive. PC or Mac.		A sleek design and Time Machine compatibility, this is the slimmest high-performance portable hard drive. PC or Mac.		Store and protect all your photos, music, videos and documents with this powerful, high-capacity desktop storage solution. PC or Mac.	
LEARN MORE	Page 5	Page 6	Page 7	Page 7	Page 8	Page 8	Page 9	Page 9	Page 11	Page 11

Wireless Mobile	<div><div>GOFLEX</div><div></div><div>GoFlex Satellite™</div></div>	Network Attached	<div><div>GOFLEX</div><div></div><div>GoFlex Home</div></div>	<div><div>BLACKARMOR®</div><div></div><div>BlackArmor NAS 440</div></div>		<div><div>BLACKARMOR®</div><div></div><div>BlackArmor NAS 400</div></div>	<div><div>BLACKARMOR®</div><div></div><div>BlackArmor NAS 220</div></div>
	PERFECT FOR		Wireless storage for your tablet	PERFECT FOR	Wireless centralized home storage	Full-system backup, RAID 0, 1, 5, 10 or JBOD	
DESCRIPTION	Take your media library on the go and stream it wirelessly to your iPad, Android tablet and smartphone. PC or Mac.	DESCRIPTION	This network storage system supports the external storage needs of every computer in your home. PC or Mac.	A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations.		A network attached storage solution designed to provide centralized storage and data backup.	
LEARN MORE	Page 6	LEARN MORE	Page 10	Page 12		Page 13	



# External Storage Solutions

Seagate external storage solutions are sleek, dependable and ultra-portable products that let your customers automatically and continuously store digital family photos, protect critical business data, back up multiple computers on a small network, or share and store videos and music.

## GoFlex®

The GoFlex ultra-portable drive makes it easy to store and protect all your files, automatically and continuously.



### Key Advantages

- Plug-and-play interface
- Preloaded backup software with encryption
- USB 3.0, FireWire 800 or powered eSATA for fast transfers
- Access and share files from anywhere.
- View your movies and photos on your TV.

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Carry files while on the go.
- Access files with both PC and Mac computers.

CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1.5TB	STAA1500100	USB 3.0	● Black	PC, Mac
1TB	STAA1000100	USB 2.0	● Black	PC, Mac
1TB	STAA1000101	USB 3.0	● Black	PC, Mac
1TB	STAA1000102	USB 3.0	● Blue	PC, Mac
1TB	STAA1000104	USB 3.0	● Silver	PC, Mac
750GB	STAA750100	USB 2.0	● Black	PC, Mac
750GB	STAA750101	USB 3.0	● Black	PC, Mac
500GB	STAA500105	USB 3.0	● Black	PC, Mac
500GB	STAA500106	USB 3.0	● Silver	PC, Mac
500GB	STAA500107	USB 3.0	● Blue	PC, Mac
500GB	STAA500108	USB 3.0	● Red	PC, Mac
500GB	STAA500100	USB 2.0	● Black	PC, Mac
500GB	STAA500101	USB 2.0	● Silver	PC, Mac
500GB	STAA500102	USB 2.0	● Blue	PC, Mac
500GB	STAA500103	USB 2.0	● Red	PC, Mac
320GB	STAA320100	USB 2.0	● Black	PC, Mac
320GB	STAA320101	USB 2.0	● Silver	PC, Mac
PRODUCT DIMENSIONS (1.5TB, 1TB, 750GB)	4.71-in L x 3.51-in W x 0.87-in D (120mm x 89mm x 22mm)			
PRODUCT DIMENSIONS (500GB)	4.33-in L x 3.27-in W x 0.59-in D (110mm x 83mm x 15mm)			
PRODUCT DIMENSIONS (1.5TB, 1TB, 750GB)	5.20-in L x 1.73-in W x 0.54-in D (132mm x 44mm x 16mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to hard drive capacity.  
<sup>2</sup> U.S. model numbers shown.

# GoFlex Satellite™

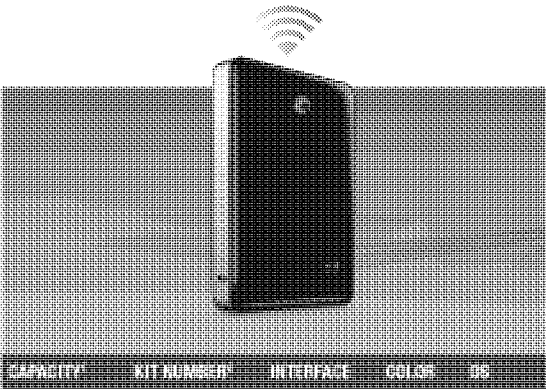
With GoFlex Satellite mobile wireless storage, you can take your media library with you. Stream it to your iPad or Android tablet.

### Key Advantages

- Take your media library with you on the go
- Stream media with up to 3 Wi-Fi enabled devices at the same time
- Automatically sync media and documents from your PC or Mac computer
- Up to 5 hours battery life<sup>3</sup>

### Best-Fit Applications

- Store and carry movies and other media on the go.
- Share media with others.
- Works with iPad or Android tablet



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STBF500101	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	4.72-in L x 3.54-in W x 0.87-in D (120mm x 90mm x 22mm)			
PACKAGE DIMENSIONS	6.30-in L x 6.69-in W x 2.13-in D (160mm x 170mm x 54mm)			

# GoFlex® Turbo

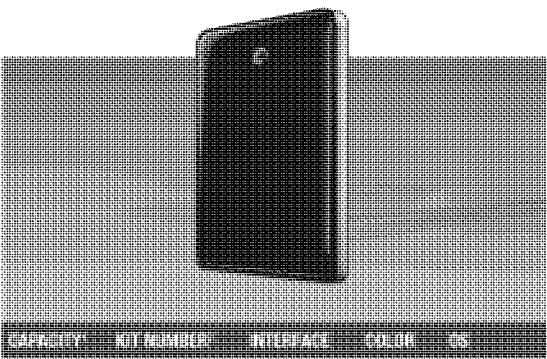
The GoFlex Turbo drive bundles high performance with extra data protection.

### Key Advantages

- SafetyNet Data Recovery Services offer additional data protection if the drive fails for any reason.
- USB 3.0 connectivity delivers up to 10x faster transfer speeds than USB 2.0 and backward compatibility.
- Preloaded with automatic backup and encryption software
- Works with both PC and Mac computers

### Best-Fit Applications

- Store or back up photos, movies, music, documents.
- Read, write and share files between PC and Mac.
- Carry files with you on-the-go.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
750GB	STAD750103	USB 3.0	● Black	PC, Mac
500GB	STAD500103	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	4.33-in L x 3.27-in W x 0.5-in D (110mm x 83mm x 13mm)			
PRODUCT DIMENSIONS (with Adapter)	4.92-in L x 3.27-in W x 0.5-in D (125mm x 83mm x 13mm)			
PACKAGE DIMENSIONS	5.2-in L x 6.54-in W x 1.73-in D (132mm x 166mm x 44mm)			

# GoFlex® for Mac

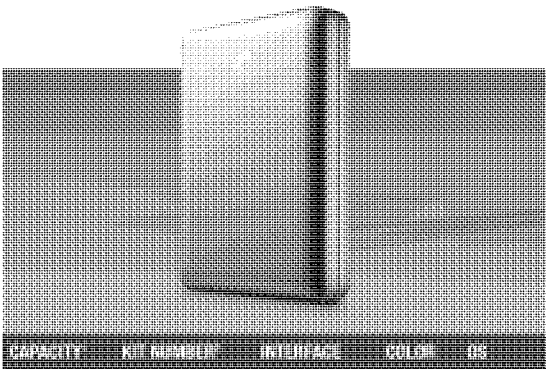
The GoFlex for Mac ultra-portable drive makes it ultra-easy to store, back up and retrieve files on-the-go from your Mac computer.

### Key Advantages

- Delivers plug-and-play connectivity with FireWire 800 or USB 2.0
- Time Machine software compatibility
- Makes it easy for you to upgrade to USB 3.0 and powered eSATA
- Use the same drive on both Mac and PC.

### Best-Fit Applications

- Read, write and share files between Mac and PC computers.
- Carry files while on-the-go.
- Store files or back up using Time Machine.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1.5TB	STBA1500100	FireWire 800/USB 2.0	● Silver	PC, Mac
1TB	STBA1000100	FireWire 800/USB 2.0	● Silver	PC, Mac
500GB	STBA50010	USB 2.0	● Silver	PC, Mac
PRODUCT DIMENSIONS (1.5TB, 1TB)	4.71-in L x 3.51-in W x 0.87-in D (120mm x 89mm x 22mm)			
PRODUCT DIMENSIONS (500GB)	4.39-in L x 3.19-in W x 0.57-in D (111mm x 83mm x 14mm)			
PACKAGE DIMENSIONS	6.1-in L x 1.73-in W x 4.69-in D (170mm x 45mm x 160mm)			

# GoFlex® Pro for Mac

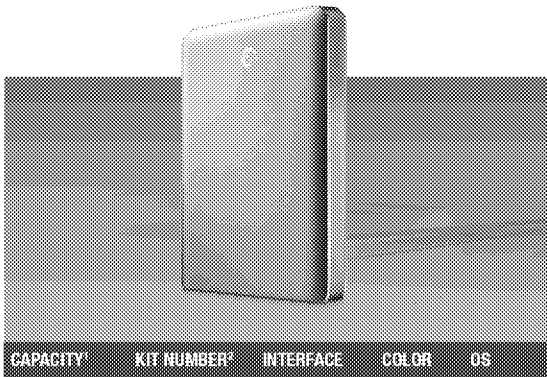
The GoFlex Pro for Mac ultra-portable drive gives you the flexibility you need to extend your digital life wherever you go.

### Key Advantages

- High-performance 7200-RPM drive
- FireWire 800 or USB 2.0 plug-and-play
- Compatible with Time Machine software
- Upgradable to USB 3.0 and powered eSATA
- Use the same drive on both Mac and PC computers

### Best-Fit Applications

- Store files or back up using Time Machine.
- Read, write and share files between Mac and PC.
- Carry files with you on-the-go.



CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
750GB	STBB750100	FireWire 800/USB 2.0	● Silver	PC, Mac
500GB	STBB500100	FireWire 800/USB 2.0	● Silver	PC, Mac
PRODUCT DIMENSIONS	4.72-in L x 3.46-in W x 0.86-in D (120mm x 88mm x 22mm)			
PACKAGE DIMENSIONS	5.63-in L x 6.3-in W x 2.17-in D (143mm x 160mm x 53mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.  
<sup>3</sup> Exact battery life subject to product model, normal usage conditions and configurations.



GoFlex® Slim

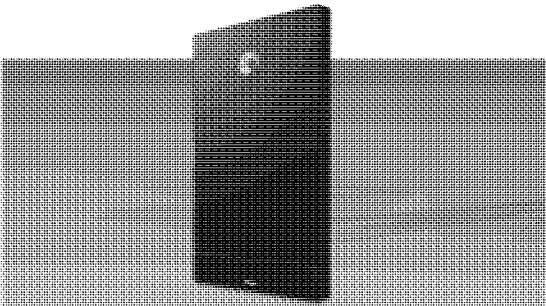
The ultra-cool GoFlex Slim performance drive delivers ultra-fast, ultra-portable on-the-go storage.

Key Advantages

- Features a sleek, ultra-thin anodized design
- Delivers USB 3.0 connectivity and performance
- Includes preloaded premium backup software with encryption and synchronization
- Works with both Mac and PC computers

Best-Fit Applications

- Increase storage capacity for mobile devices.
- Carry files with you anywhere and everywhere.
- Read, write and share files between Mac and PC.
- Help keep files safe and secure.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
500GB	STBE500100	USB 3.0	● Black	PC, Mac
320GB	STBE320100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	4.91-in L x 3.07-in W x 0.354-in D (124mm x 78mm x 9mm)			
PACKAGE DIMENSIONS	6.30-in L x 2.56-in W x 4.21-in D (160mm x 65mm x 107mm)			

GoFlex® Desk

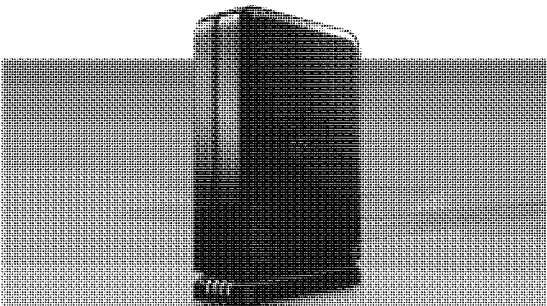
The GoFlex Desk external drive delivers high-capacity storage and automatic, continuous backup and encryption with its preloaded software.

Key Advantages

- Plug-and-play interface
- Preloaded premium backup software with encryption
- USB 2.0 or USB 3.0 adapter with capacity gauge display
- Upgrade to a faster interface with a GoFlex desk adapter.
- Offers both vertical and horizontal drive orientation

Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Access files with both PC and Mac computers.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STAC4000100	USB 3.0	● Black	PC, Mac
3TB	STAC3000100	USB 2.0	● Black	PC, Mac
3TB	STAC3000102	USB 3.0	● Black	PC, Mac
2TB	STAC2000100	USB 2.0	● Black	PC, Mac
2TB	STAC2000106	USB 3.0	● Black	PC, Mac
1TB	STAC1000100	USB 2.0	● Black	PC, Mac
1TB	STAC1000103	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

GoFlex® Slim for Mac

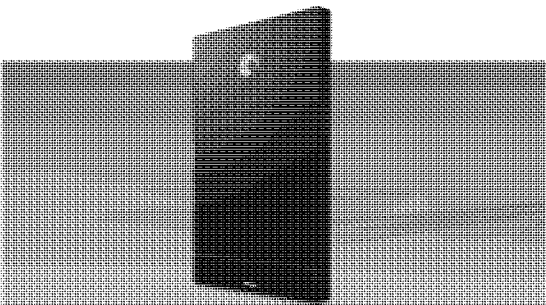
The GoFlex Slim for Mac performance drive has a sleek, ultra-thin enclosure and is Time Machine-ready.

Key Advantages

- Sleek, ultra-thin anodized design
- Compatible with Time Machine software
- USB 2.0 plug-and-play
- Use the same drive on both Mac and PC computers.

Best-Fit Applications

- Increase storage capacity for mobile devices.
- Carry files with you anywhere and everywhere.
- Read, write and share files between Mac and PC.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
500GB	STBL500100	USB 2.0	● Black	PC, Mac
320GB	STBL320100	USB 2.0	● Black	PC, Mac
PRODUCT DIMENSIONS	4.91-in L x 3.07-in W x 0.354-in D (124mm x 78mm x 9mm)			
PACKAGE DIMENSIONS	6.30-in L x 2.56-in W x 4.21-in D (160mm x 65mm x 107mm)			

GoFlex® Desk for Mac

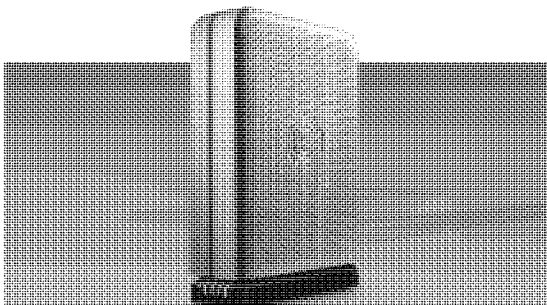
The GoFlex Desk for Mac delivers high-capacity storage and Time Machine compatibility for your Mac computer.

Key Advantages

- FireWire 800 or USB 2.0 plug-and-play
- Use the same drive on both Mac and PC computers
- Upgradable to USB 3.0
- FireWire 800/USB 2.0 desktop adapter with capacity gauge display
- Both vertical and horizontal drive orientation

Best-Fit Applications

- Back up using Time Machine software.
- Read, write and share files between Mac and PC.
- Take advantage of faster FireWire 800 interface.
- Expand storage capacity.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STBC4000100	FireWire 800/USB 2.0	● Silver	PC, Mac
3TB	STBC3000101	FireWire 800/USB 2.0	● Silver	PC, Mac
2TB	STBC2000101	FireWire 800/USB 2.0	● Silver	PC, Mac
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158 x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			



GoFlex® Home

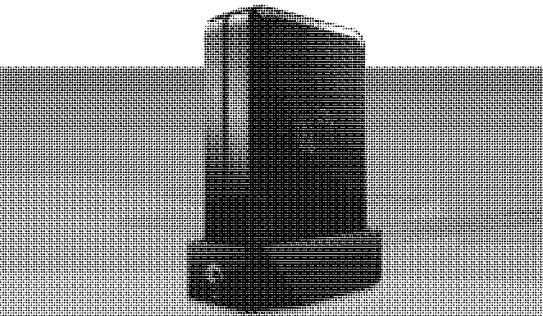
The GoFlex Home network storage system allows you to create secure in-home cloud storage for multiple computers in the home.

Key Advantages

- Connects to your WiFi router
- Simple setup in just minutes
- Automatic and continuous backup
- Easily update storage capacity or plug in external drives—no tools required.

Best-Fit Applications

- Back up multiple home PC and Mac computers.
- Store files in a central location.
- Access files from computers and mobile devices over the Internet.
- Stream media to game consoles and media players.
- Share a USB printer with all computers in the home.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
3TB	STAM3000100	SATA/GigE	● Black	PC, Mac
2TB	STAM2000100	SATA/GigE	● Black	PC, Mac
1TB	STAM1000100	SATA/GigE	● Black	PC, Mac
PRODUCT DIMENSIONS	3.13-in L x 5.31-in W x 6.75-in D (80mm x 135mm x 171mm)			
PACKAGE DIMENSIONS	10.04-in L x 3.07-in W x 7.64-in D (255mm x 78mm x 194mm)			

Expansion™ External

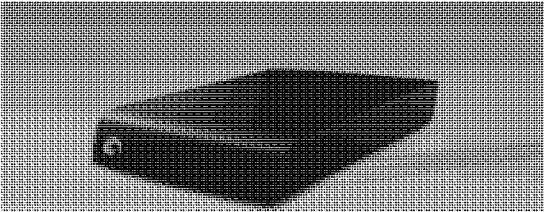
Expansion External desktop drives provide instant add-on storage for your ever-growing collection of files.

Key Advantages

- Plug-and-play, no software to install
- Simply drag and drop to save files.
- Built-in power management ensures energy-efficient operation

Best-Fit Applications

- Instantly add more storage space to your computer.
- Free space on your internal hard drive to increase computer performance.
- Consolidate all your files to a single location.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
3TB	STAY3000102	USB 3.0	● Black	PC, Mac
2TB	STAY2000102	USB 3.0	● Black	PC, Mac
1TB	STAY1000102	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	4.98-in W x 1.57-in H x 8.15-in D (125.98mm x 39.88mm x 207.08mm)			
PACKAGE DIMENSIONS	9.69-in W x 8.62-in H x 3.07-in D (246.12mm x 218.95mm x 77.97mm)			

Expansion™ Portable

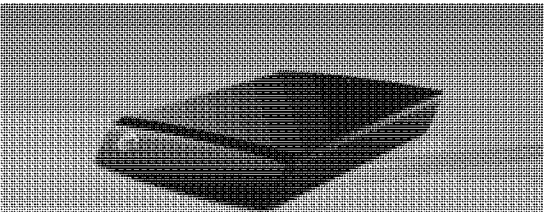
Expansion Portable add-on storage lets you free space on your internal drive and take large files on the go.

Key Advantages

- Plug-and-play, no software to install
- Simply drag and drop to save files.
- USB powered
- Built-in power management ensures energy-efficient operation

Best-Fit Applications

- Instantly add more storage space to your computer.
- Take large files with you when you travel.

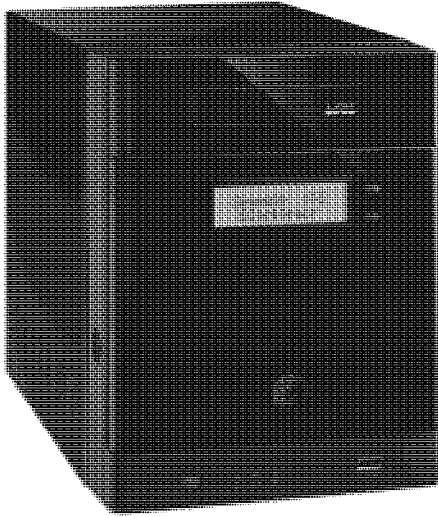


CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
1.5TB	STAX1500102	USB 3.0	● Black	PC, Mac
1TB	STAX1000102	USB 3.0	● Black	PC, Mac
750GB	STAX750102	USB 3.0	● Black	PC, Mac
500GB	STAX500102	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS (1.5TB, 1TB)	3.31-in W x 1.06-in H x 5.97-in D (84.07mm x 26.92mm x 151.64mm)			
PRODUCT DIMENSIONS (750GB, 500GB)	3.15-in W x 0.69-in H x 5.38-in D (80.01mm x 17.60mm x 136.65mm)			
PACKAGE DIMENSIONS	5.20-in W x 1.73-in D x 6.54-in L (132.08mm x 43.94mm x 166.12mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown

BlackArmor®  
NAS 440/400

A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations



Key Advantages

- BlackArmor NAS 440 models include four drives to increase capacity and take advantage of RAID 5/10 options.
- BlackArmor NAS 400 model available without pre-installed drives for maximum flexibility.
- Designed for small business to provide optimum uptime and data integrity
- User-configurable RAID 0/1/5/10 and JBOD
- Continuous and automatic full-system backup for network connected workstations<sup>3</sup>
- Hot-swappable, user-serviceable drives—no tools required

Best-Fit Applications

- Store and access files from a central, secure location.
- Access and manage files remotely.
- Back up or move files to a secondary storage device.
- Automatically perform full-system backups on network-connect PCs.
- Share a USB printer with network-connected PCs and Macs.
- Encrypt individual files to entire volumes of data.
- Stream media with DLNA or iTunes.

CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
12TB	STAU12000100	Gigabit Ethernet	● Black	PC, Mac
8TB	ST380005SHA10G-RK	Gigabit Ethernet	● Black	PC, Mac
4TB	ST340005SHA10G-RK	Gigabit Ethernet	● Black	PC, Mac
—	STAR401	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS		6.30-in W x 8.15-in H x 10.59-in D (160.00mm x 207.00mm x 269.00mm)		
PACKAGE DIMENSIONS		9.29-in W x 9.50-in H x 14.37-in D (236.00mm x 241.30mm x 365.00mm)		

BlackArmor® NAS 220

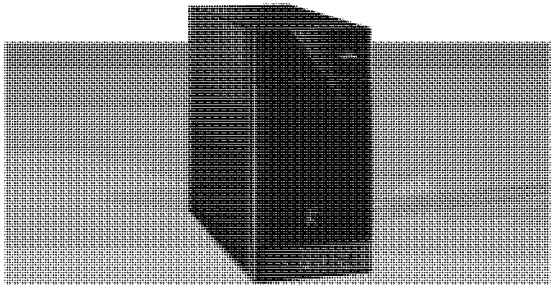
A small-business-specific network attached storage solution designed for centralized storage and data backup for up to 20 PCs

Key Advantages

- Automatic data mirroring with RAID 1
- Protect network-connected PCs with incremental and full-system, automatic backup<sup>3</sup>
- Functions as FTP server for remote access
- Includes two reliable, user-replaceable drives
- Secure files with hardware-based encryption.

Best-Fit Applications

- Central, secure file storage and access
- Access and manage files remotely.
- Share a printer with connected PCs and Macs.

















CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
6TB	STAV6000100	Gigabit Ethernet	● Black	PC, Mac
4TB	ST340005LSA10G-RK	Gigabit Ethernet	● Black	PC, Mac
2TB	ST320005LSA10G-RK	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS		4.09-in W x 7.79-in H x 7.40-in D (104.00mm x 197.80mm x 188.00mm)		
PACKAGE DIMENSIONS		10.90-in W x 6.13-in H x 11.00-in D (276.86mm x 155.70mm x 279.40mm)		

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to hard drive capacity.  
<sup>2</sup> U.S. model numbers shown.  
<sup>3</sup> Includes 10 software licenses; additional licenses available at [www.seagate.com](http://www.seagate.com)

# Internal Storage

## At-a-Glance Product Comparison

3.5-inch	DESKTOP		ENTERPRISE		ENTERPRISE		VIDEO STORAGE	
								
	Barracuda®	Cheetah® 15K	Constellation® ES.2	Constellation ES	Cheetah NS	SV35 Series™	Pipeline® HD	
BUSINESS NEED	Mainstream	Performance	Mainstream	Mainstream	Low Power	Surveillance	DVR	
USE THIS DRIVE FOR	Desktop compute where choice in capacity and cache options to provide design flexibility is important	High-capacity, compute-intensive requirements demanding high performance and availability	Bulk-data applications requiring reliable, highest-capacity storage, efficiency and enterprise-class reliability	Maximum-capacity enterprise servers and storage arrays requiring enterprise-class reliability	Mainstream data requiring high capacity, low power and high availability	Surveillance systems that require high performance, low-power, ruggedized and centralized storage for every surveillance application	DVR systems where reliable, low-power, purpose-built storage is required for video streaming applications	
ENCRYPTION MODELS AVAILABLE		X	X	X				
LEARN MORE	Page 18	Page 29	Page 30	Page 31	Page 30	Page 36	Page 36	

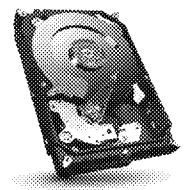
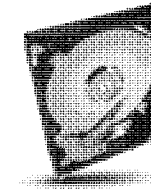
2.5-inch	LAPTOP			ENTERPRISE			ENTERPRISE SSD	
								
	Momentus® XT	Momentus	Momentus Thin	Savvio® 15K	Savvio 10K	Constellation 2™	Pulsar® XT.2	Pulsar2™
BUSINESS NEED	Performance	Mainstream	Thin (7mm z-ht.)	Performance	Mainstream	Low Power	Performance	Mainstream
USE THIS DRIVE FOR	The ultimate mobile computing experience, with SSD-like performance for all applications and OS environments	Laptop PCs where the lowest power consumption, silent acoustics and the highest quality is always expected	Slim computing devices such as thin laptops and netbooks, where z-height makes all the difference	Compute-intensive data requirements demanding the highest performance density and availability	Mainstream data requiring high capacity, performance density and reliability	Online reference data demands requiring cost-effective, low-power, enterprise-class drives	Demanding data centers requiring ultra-high performance and the highest levels of data integrity and drive endurance	Enterprise environments requiring MLC-enabled, high-capacity SSD with data integrity and drive endurance
ENCRYPTION MODELS AVAILABLE		X	X	X	X	X	X	X
LEARN MORE	Page 22	Page 23	Page 24	Page 29	Page 28	Page 32	Page 33	Page 33



# Desktop Storage Solutions

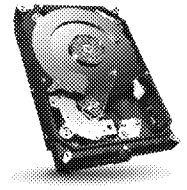
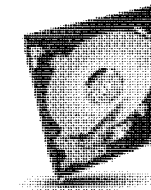
Seagate has a distinguished history in consistently delivering innovative technologies, super-sized capacities, low power and blazing-fast performance. Seagate desktop drives offer excellent performance at all levels.

## Product Comparison



	BARRACUDA® 3.5-INCH INTERNAL KIT	BARRACUDA
Application	Mainstream	Mainstream and Performance
Description	The fast, powerful and easy way to upgrade or add storage capacity to desktop computers	Tuned performance for low-power, mainstream and high-performance desktop computing
Form Factor	3.5 inch	3.5 inch
Performance	7200 RPM	7200 RPM
Reliability (AFR)	<1%	<1%
Max. Ext. Transfer Rate	300MB/s to 600MB/s	600MB/s
Capacity <sup>1</sup>	500GB to 3TB	250GB to 3TB
Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 6Gb/s
Cache	16MB to 64MB	16MB to 64MB
Power (Idle)		3.36W to 7.37W

## Feature Comparison



	MAINSTREAM	MAINSTREAM AND PERFORMANCE
Product	Barracuda 3.5-Inch Internal Kit	Barracuda
SATA Interface	X	X
Sustainable Technology	X	X
Best-in-Class Performance		X
Capacity Leadership	X	X
Quiet Acoustics	X	
DiscWizard™ Installation Software	X	X
Compatible with Windows 7 <sup>2</sup>	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 7, visit <http://www.microsoft.com/windows/compatibility/windows-7/en-us/search.aspx?type=Hardware&id=Seagate>

Barracuda®

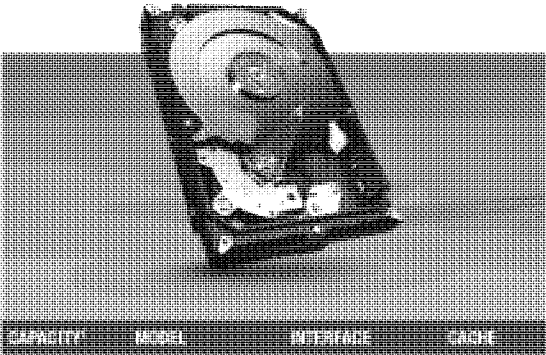
Seagate Barracuda drives give you the Power of One with 1TB-per-disk technology and one drive platform for every capacity and application.

Key Advantages

- Up to 3TB capacity with 7200-RPM performance
- AcuTrac™ and OptiCache™ technologies deliver dependable overall performance.
- Seagate SmartAlign™ technology provides simple migration to Advanced Format 4K sectors.
- Free Seagate DiscWizard™ software

Best-Fit Applications

- Desktop or all-in-one PCs and home servers
- PC-based gaming systems
- Desktop RAID
- Direct-attached external storage devices (DAS)
- Network-attached storage devices (NAS)



CAPACITY	MODEL	INTERFACE	CACHE
3TB	ST3000DM001	SATA 6Gb/s NCQ	64MB
2TB	ST2000DM001	SATA 6Gb/s NCQ	64MB
1.5TB	ST1500DM003	SATA 6Gb/s NCQ	64MB
1TB	ST1000DM003	SATA 6Gb/s NCQ	64MB
750GB	ST750DM003	SATA 6Gb/s NCQ	64MB
500GB	ST500DM002	SATA 6Gb/s NCQ	16MB
320GB	ST320DM000	SATA 6Gb/s NCQ	16MB
250GB	ST250DM000	SATA 6Gb/s NCQ	16MB

Barracuda® 3.5-Inch Internal Kit

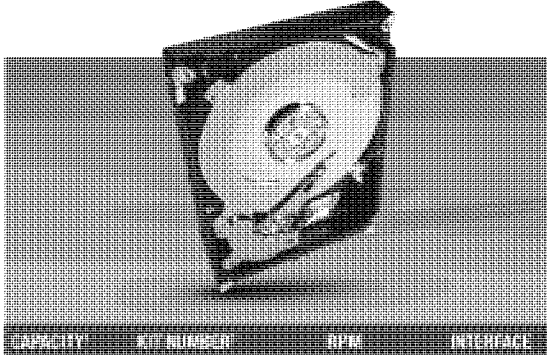
Seagate 3.5-inch internal drives are the fast, powerful, and easy way to upgrade or add storage capacity to desktop computers.

Key Advantages

- Quiet, ultra-high performance
- DiscWizard™ software makes installation a snap
- Built-in self-monitoring technology helps ensure maximum reliability

Best-Fit Applications

- Gaming PCs
- Workstations
- High-end PCs
- Desktop RAID
- Mainstream/office PCs




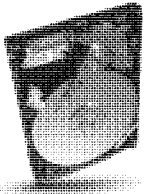
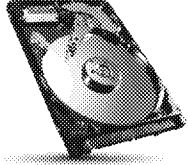
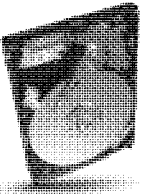
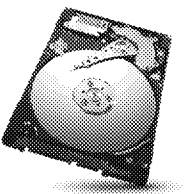
CAPACITY	MODEL	RPM	INTERFACE
3TB	STBD3000100	7200	SATA 6Gb/s
1TB	ST310005N1A1AS-RK	7200	SATA 3Gb/s
500GB	ST3500641AS-RK	7200	SATA 3Gb/s
PACKAGE DIMENSIONS	7.38-in L x 5.88-in W x 2.88-in D (187mm x 149mm x 73mm)		



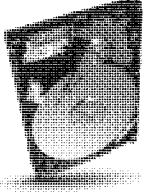
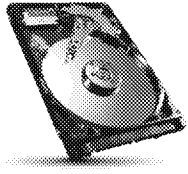
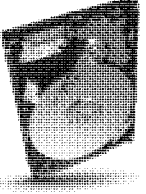
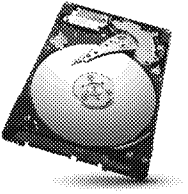
# Laptop Storage Solutions

Seagate laptop drives address every mobile market need, delivering superior performance, reliability and value. Feature-rich with innovative options, the Seagate laptop lineup also includes self-encryption and FIPS 140-2 validated models.

## Product Comparison

					
	MOMENTUS® 2.5-INCH INTERNAL KIT	MOMENTUS XT	MOMENTUS	MOMENTUS THIN	
Application	Mainstream and Performance	Extreme Performance	Mainstream	Slim Computing	
Description	A complete upgrade kit to transform your system to high performance or just add capacity	Solid state hybrid drives deliver SSD-like performance without sacrificing capacity	The best combination of capacity, mobility and durability in a laptop hard drive	The world's thinnest 2.5-inch drive for slim laptops and netbooks	
Form Factor	2.5 inch	2.5 inch	2.5 inch	7mm, 2.5 inch	
Performance	5400 RPM to 7200 RPM	7200 RPM	5400 RPM to 7200 RPM	5400 RPM to 7200 RPM	
Reliability (AFR)	0.40% to 0.50%	0.50%	0.48% to 0.50%	0.48%	
Max. Ext. Transfer Rate	300MB/s	300MB/s to 600MB/s	300MB/s	300MB/s	
Capacity <sup>1</sup>	250GB to 750GB	500GB to 750GB	160GB to 750GB	160GB and 300GB	
Interface	SATA 3Gb/s	SATA 3Gb/s, SATA 6Gb/s	SATA 3Gb/s	SATA 3Gb/s	
Cache	8MB to 32MB	32MB	8MB to 16MB	16MB	
Power (Idle)		0.8W to 1.1W	0.5W to 0.81W	0.48% to 0.66%	

## Feature Comparison

				
	MAINSTREAM AND PERFORMANCE	EXTREME PERFORMANCE	MAINSTREAM	SLIM COMPUTING
Product	Momentus 2.5-inch Internal Kit	Momentus XT	Momentus	Momentus Thin
SATA Interface	X	X	X	X
Lowest Acoustics			X	X
Lowest Power			X	X
Self-Encrypting Drive			X	X
Drop Sensor Options			X	
Solid State Hybrid	X	X		
Compatible with Windows 7 <sup>2</sup>	X	X	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 7, visit <http://www.seagate.com/windows/compatibility/windows-7/en-us/Search.aspx?Type=Hardware&Seagate>



# Momentus® XT

Experience the FAST Factor™ Advantage

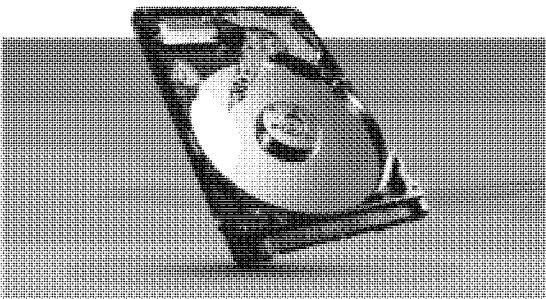
The Seagate Momentus XT solid state hybrid drive enables laptop PC users to enjoy solid state performance without sacrificing capacity.

### Key Advantages

- Boots and performs like an SSD<sup>1</sup>
- Up to 3x faster than a traditional HDD<sup>2</sup>
- SATA 6Gb/s with NCQ for interface speed
- All-in-one design for simplicity and ease of installation
- Works in any laptop or PC, any OS and any application
- Backed by a 3-year limited warranty

### Best-Fit Applications

- Laptops and mobile workstations
- Desktop and tower workstations
- High-performance laptop and desktop gaming systems
- Small form factor all-in-one PCs



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
750GB	ST750LX003	SATA 6Gb/s	32MB
500GB	ST95005620AS	SATA 3Gb/s	32MB

# Momentus®

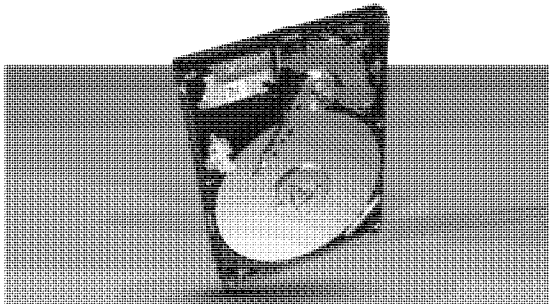
The Seagate Momentus drive offers the world's most feature-rich 2.5-inch family of storage for laptops and external enclosures.

### Key Advantages

- Innovative options and features—the power to transform from ordinary to extraordinary
- 7200 RPM delivers a constant high-performance boost.
- 5400 RPM enables affordable, low-power and high-capacity drives for external enclosures.
- Self-Encrypting Drive options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification<sup>4</sup> are government-approved for the U.S. and Canadian governments.
- G-Force Protection™ technology can help keep your data recoverable after a fall, even if your laptop doesn't survive.
- Seagate Smartalign™ technology provides a transition to 4K sectors without the need for software utilities.

### Best-Fit Applications

- Mainstream and high-performance laptops
- External storage solutions, boxes
- Industrial applications requiring a small form factor



CAPACITY <sup>1</sup>	7200-RPM MODEL	INTERFACE	CACHE
750GB	ST9750420AS <sup>3</sup>	SATA 3Gb/s	16MB
500GB	ST9500423AS <sup>3</sup>	SATA 3Gb/s	16MB
500GB	ST9500420ASG <sup>2</sup>	SATA 3Gb/s	16MB
500GB	ST9500421AS <sup>5</sup>	SATA 3Gb/s	16MB
500GB	ST9500422AS <sup>5</sup>	SATA 3Gb/s	16MB
320GB	ST9320423AS	SATA 3Gb/s	16MB
320GB	ST320LT023 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250410AS	SATA 3Gb/s	16MB
250GB	ST250LT021 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250410ASG <sup>2</sup>	SATA 3Gb/s	16MB
250GB	ST9250411AS <sup>5</sup>	SATA 3Gb/s	16MB
250GB	ST9250412AS <sup>1,6</sup>	SATA 3Gb/s	16MB
160GB	ST9160412AS	SATA 3Gb/s	16MB
160GB	ST160LT016 <sup>3,4</sup>	SATA 3Gb/s	16MB

CAPACITY <sup>1</sup>	5400-RPM MODEL	INTERFACE	CACHE
750GB	ST9750423AS <sup>3</sup>	SATA 3Gb/s	16MB
640GB	ST9640320AS	SATA 3Gb/s	8MB
500GB	ST9500325AS	SATA 3Gb/s	8MB
500GB	ST9500325ASG <sup>2</sup>	SATA 3Gb/s	8MB
500GB	ST9500327AS <sup>5</sup>	SATA 3Gb/s	8MB
320GB	ST9320325AS	SATA 3Gb/s	8MB
320GB	ST320LT022 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250315AS	SATA 3Gb/s	8MB
250GB	ST250LT020 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250317AS <sup>5</sup>	SATA 3Gb/s	8MB
160GB	ST9160314AS	SATA 3Gb/s	8MB
160GB	ST160LT015 <sup>3,4</sup>	SATA 3Gb/s	16MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Drive with G-Force Protection™ feature.  
<sup>3</sup> Advanced Format (4K) drive with SmartAlign™ technology requires misalignment conditions.  
<sup>4</sup> 7mm 2.5-height expanded to 9.5mm enables compatibility with standard laptop chassis.  
<sup>5</sup> Self-Encrypting Drive model.  
<sup>6</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/memos/documents/140-1/1401vend.htm>.  
<sup>7</sup> Performance may vary depending on user's hardware configuration and operating system. Testing performed on a Momentus XT 750GB 55MB.

Momentus® Thin

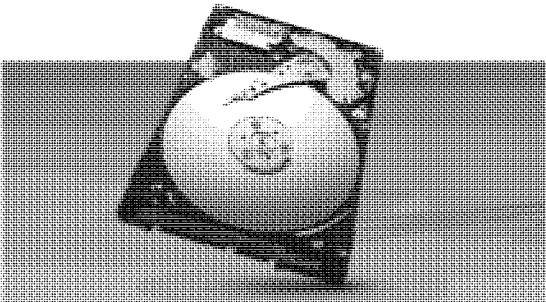
The 7mm, 2.5-inch drive enables slim computing for all types of mobile computing, from laptops to netbooks to smaller desktop PCs.

Key Advantages

- 7mm z-height form factor enables thin chassis design for all segments of laptop computing.
- Seagate SmartAlign™ technology provides a transition to 4K sectors without the need for software utilities.
- Self-Encrypting Drive options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification<sup>5</sup> are government-approved for the U.S. and Canadian governments.

Best-Fit Applications

- Thin entry-level laptop PCs
- Thin high-end netbooks
- Thin ultraportables
- Slim CE devices



CAPACITY <sup>1</sup>	7200-RPM MODEL	INTERFACE	CACHE
320GB	ST320LT007	SATA 3Gb/s	16MB
320GB	ST320LT014 <sup>2</sup>	SATA 3Gb/s	16MB
320GB	ST320LT009 <sup>3,3</sup>	SATA 3Gb/s	16MB
250GB	ST250LT007	SATA 3Gb/s	16MB
250GB	ST250LT014 <sup>2</sup>	SATA 3Gb/s	16MB
250GB	ST250LT009 <sup>3,3</sup>	SATA 3Gb/s	16MB
160GB	ST160LT007	SATA 3Gb/s	16MB

CAPACITY <sup>1</sup>	5400-RPM MODEL	INTERFACE	CACHE
500GB	ST500LT025 <sup>2,4</sup>	SATA 3Gb/s	16MB
500GB	ST500LT015 <sup>3,4</sup>	SATA 3Gb/s	16MB
500GB	ST500LT012	SATA 3Gb/s	16MB
320GB	ST320LT020	SATA 3Gb/s	16MB
320GB	ST320LT012 <sup>4</sup>	SATA 3Gb/s	16MB
250GB	ST250LT003	SATA 3Gb/s	16MB
250GB	ST250LT012 <sup>4</sup>	SATA 3Gb/s	16MB
160GB	ST160LT003	SATA 3Gb/s	16MB

Momentus® 2.5-Inch Internal Kit

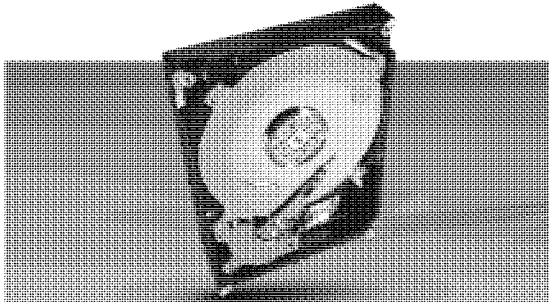
Seagate 2.5-inch internal drives deliver vast amounts of storage for adding capacity or upgrading drives in laptop computers.

Key Advantages

- Built for mobility
- Preserves battery life
- Large data cache
- Outstanding performance
- Momentus XT solid state hybrid model offers SSD-like performance with the capacity of a hard drive.

Best-Fit Applications

- Replacement laptop drives
- Laptop storage upgrades
- High-end laptops and workstations



CAPACITY <sup>1</sup>	KIT NUMBER	RPM	INTERFACE
750GB	ST907503N1A1AS-RK	7200	SATA 3Gb/s
640GB	ST906403N1A1AS-RK	5400	SATA 3Gb/s
500GB	ST905003N3A1AS-RK	7200	SATA 3Gb/s
500GB	ST905003N1A1AS-RK	5400	SATA 3Gb/s
320GB	ST903203N3A1AS-RK	7200	SATA 3Gb/s
320GB	ST903203N1A2AS-RK	5400	SATA 3Gb/s
250GB	ST90250N1A1AS-RK	5400	SATA 3Gb/s

PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)
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MOMENTUS XT MODEL			
750GB	STBD750100	7200	SATA 3Gb/s

PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)
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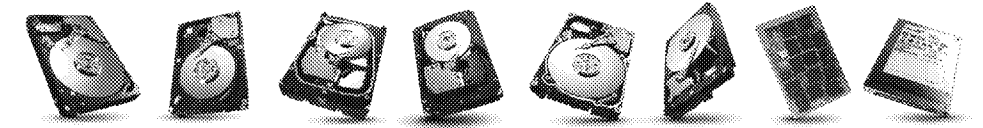
<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/strep/documents/f140-1/f1401vend.htm>.  
<sup>4</sup> SmartAlign technology is not available on this model.  
<sup>5</sup> U.S. model numbers shown.



# Enterprise Storage Solutions

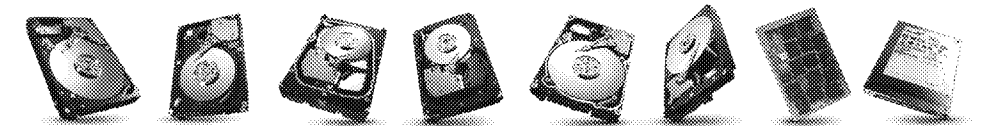
Seagate has the enterprise storage expertise as well as the global presence, processes and resources to consistently support small or medium businesses and run a large data center with the industry's highest-quality enterprise storage products, including FIPS 140-2 validated models.

## Product Comparison



	SAVVIO®	CHEETAH®	CONSTELLATION®	PULSAR®
Application	SFF Performance and Mainstream	LFF Performance and Mainstream	High Capacity and Low Power	Mainstream and Performance SSD
Description	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 2.5-inch form factor	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 3.5-inch form factor	High-capacity, lowest-power, reliable 7200-RPM enterprise hard drive in both 2.5- and 3.5-inch form factors	Performance, data integrity and drive endurance in an enterprise solid state drive
Form Factor	2.5-inch	3.5-inch	2.5-inch and 3.5-inch	2.5-inch
Performance	15K RPM and 10K RPM	15K RPM and 10K RPM	7200 RPM	MLC and SLC
Reliability (AFR)	0.44%	0.55%	0.62% and 0.73%	0.44%
Capacity <sup>1</sup>	146GB to 900GB	300GB to 600GB	250GB to 3TB	100GB to 800GB
Power (Idle)	3.5W to 4.4W	5.6W to 11.68W	2.52W to 7.7W	3.47W to 5.92W
Interface	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, SATA 6Gb/s	6Gb/s SAS, SATA 6Gb/s
Limited Warranty <sup>4</sup>	5 years	5 years	3 years and 5 years	5 years

## Feature Comparison



	2.5-inch Mission Critical		3.5-inch Mission Critical		2.5-inch Nearline	3.5-inch Nearline	Performance SSD	Mainstream SSD
Product	Savvio 15K	Savvio 10K	Cheetah 15K	Cheetah NS	Constellation	Constellation ES	Pulsar XT.2	Pulsar.2
Best-in-Class Performance	X		X		X	X	X	
Capacity Leadership		X	X	X		X		X
Vibration Tolerance for Multi-Drive Stabilization	X	X	X	X	X	X		
6Gb/s SAS Interface	X	X	X	X	X	X	X	X
4Gb/s FC Interface		X	X	X				
6Gb/s SATA Interface					X	X	X	X
Best-in-Class Power Usage		X		X	X	X		
PowerChoice™ Optimized Idle Power Settings		X			X	X		
Self-Encrypting Drive (SED) <sup>2</sup>	X	X	X		X	X	X	X
FIPS 140-2 SED <sup>2,3</sup>	X	X	X		X	X		

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Encrypting Drive models may require 100-compliant host or controller support.

<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STIM/crep/documents/f140-1/1401vend.htm>

<sup>4</sup> Warranty terms may vary based on usage. Contact your Seagate sales representative for warranty terms and conditions.

Savvio® 10K

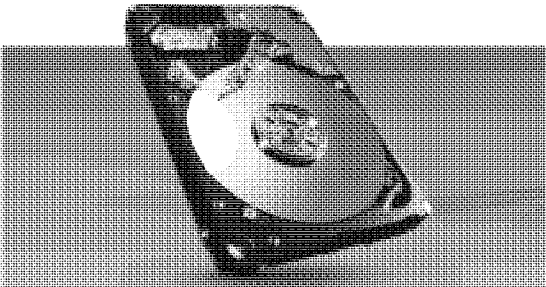
Seagate Savvio 10K drives deliver the optimal balance of capacity, performance and power in a 10K-RPM, 2.5-inch enterprise drive.

Key Advantages

- Highest-capacity enterprise SFF hard drive (up to 900GB)
- PowerChoice™ technology reduces power consumption.
- First SFF 10K-RPM drive to support 4Gb/s FC
- Protection Information (PI) option detects corruption of data in flight between the host system and the drive<sup>4</sup>
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- Mission-critical servers and external storage arrays
- Power- and space-constrained data centers
- Compliance or data security initiatives



CAPACITY	MODEL	INTERFACE	CACHE
900GB	ST9900805SS	6Gb/s SAS	64MB
900GB	ST9900705SS <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST9900605SS <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST9900805FC	6Gb/s SAS	64MB
600GB	ST9600205SS	6Gb/s SAS	64MB
600GB	ST9600105SS <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600005SS <sup>2,3</sup>	6Gb/s SAS	64MB
600GB	ST9600205FC	6Gb/s SAS	64MB
450GB	ST9450405SS	6Gb/s SAS	64MB
450GB	ST9450305SS <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450205SS <sup>2,3</sup>	6Gb/s SAS	64MB
450GB	ST9450405FC	6Gb/s SAS	64MB
300GB	ST9300605SS	6Gb/s SAS	64MB
300GB	ST9300505SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300405SS <sup>2,3</sup>	6Gb/s SAS	64MB
300GB	ST9300605FC	6Gb/s SAS	64MB

Savvio® 15K

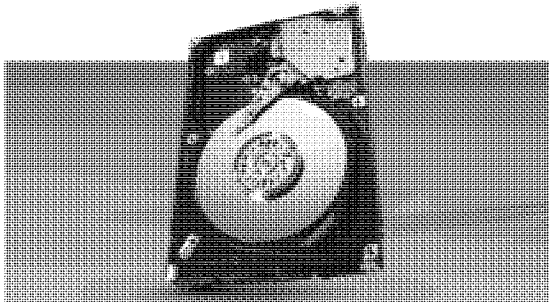
The 2.5-inch Seagate Savvio 15K hard drive provides the world's highest performance and reliability while delivering ultra-low power consumption.

Key Advantages

- Stores twice the amount of Tier 1 data without increasing drive count
- Enables Tier 1 applications to process transactions more quickly
- Reduces system complexity and operating costs
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- High-performance enterprise servers and storage arrays
- Transaction-intensive database applications
- Blade, rack and tower servers
- Security compliance-driven IT organizations



CAPACITY	MODEL	INTERFACE	CACHE
300GB	ST9300653SS	6Gb/s SAS	64MB
300GB	ST9300553SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300453SS <sup>2,3</sup>	6Gb/s SAS	64MB
146GB	ST9146853SS	6Gb/s SAS	64MB
146GB	ST9146753SS <sup>2</sup>	6Gb/s SAS	64MB
146GB	ST9146653SS <sup>2,3</sup>	6Gb/s SAS	64MB
146GB	ST9146852SS	6Gb/s SAS	16MB
146GB	ST9146752SS <sup>2</sup>	6Gb/s SAS	16MB
146GB	ST9146652SS <sup>2,3</sup>	6Gb/s SAS	16MB
73GB	ST973452SS	6Gb/s SAS	16MB
73GB	ST973352SS <sup>2</sup>	6Gb/s SAS	16MB
73GB	ST973252SS <sup>2,3</sup>	6Gb/s SAS	16MB

Cheetah® 15K

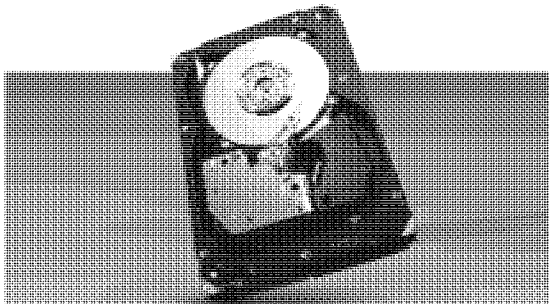
The Seagate Cheetah 15K drive provides the highest capacity, performance and reliability in 3.5-inch mission-critical storage.

Key Advantages

- Third-generation perpendicular recording
- Sustained data rate of up to 204MB/s
- Industry's highest 3.5-inch drive reliability
- Powertrim™ technology optimizes power consumption
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- Business and transaction processing
- Email and decision support
- Storage Area Networks (SAN)
- Network Attached Storage (NAS)
- Internet and e-commerce



CAPACITY	MODEL	INTERFACE	CACHE
600GB	ST3600057SS	6Gb/s SAS	16MB
600GB	ST3600957SS <sup>2</sup>	6Gb/s SAS	16MB
600GB	ST3600857SS <sup>2,3</sup>	6Gb/s SAS	16MB
600GB	ST3600057FC	4Gb/s FC	16MB
450GB	ST3450857SS	6Gb/s SAS	16MB
450GB	ST3450757SS <sup>2</sup>	6Gb/s SAS	16MB
450GB	ST3450657SS <sup>2,3</sup>	6Gb/s SAS	16MB
450GB	ST3450857FC	4Gb/s FC	16MB
300GB	ST3300657SS	6Gb/s SAS	16MB
300GB	ST3300557SS <sup>2</sup>	6Gb/s SAS	16MB
300GB	ST3300457SS <sup>2,3</sup>	6Gb/s SAS	16MB
300GB	ST3300657FC	4Gb/s FC	16MB

<sup>1</sup>One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup>Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup>See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/convg/documents/140-1/1401vend.htm>.  
<sup>4</sup>Protection Information (PI) feature requires PI-compliant host or controller support.



# Cheetah® NS

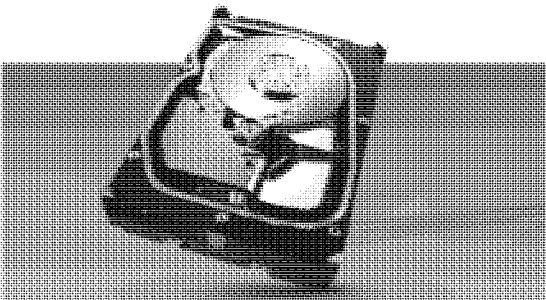
The Seagate Cheetah NS drive delivers the lowest-power, highest-reliability combination for 3.5-inch Tier 1 solutions.

### Key Advantages

- Highest-capacity Tier 1 drive (600GB)
- Highest LFF reliability rating in the industry, with a 0.55% annualized failure rate (AFR)
- Seagate PowerTrim technology dynamically reduces power usage.

### Best-Fit Applications

- Mainstream enterprise applications
- Business and transaction processing
- Storage Area Networks (SAN)
- Network Attached Storage (NAS)



CAPACITY	MODEL	INTERFACE	CACHE
600GB	ST3600002SS	6Gb/s SAS	16MB
600GB	ST3600002FC	4Gb/s FC	16MB
450GB	ST3450802SS	6Gb/s SAS	16MB
450GB	ST3450802FC	4Gb/s FC	16MB
300GB	ST3300602FC	4Gb/s FC	16MB

# Constellation® ES

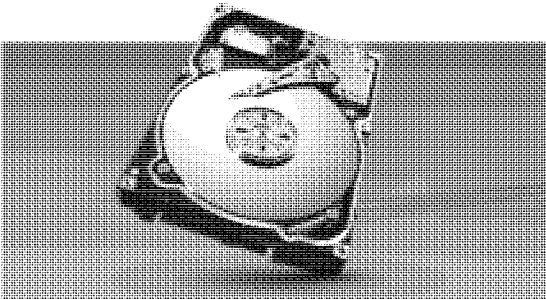
Seagate Constellation ES 3.5-inch hard drives offer the highest capacity at 2TB while providing enterprise robustness for seamless enterprise integration.

### Key Advantages

- Enterprise nearline drive designed for 24x7 operation
- Best-in-class rotational vibration tolerance
- Multi-drive firmware maximizes system availability.
- Optimal power savings with PowerChoice™ technology
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data.
- FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- High-capacity data center storage
- Mainstream enterprise external storage arrays
- Enterprise backup and restore
- Cloud storage



CAPACITY	MODEL	INTERFACE	CACHE
2TB	ST2000NM0011	SATA 6Gb/s	64MB
2TB	ST2000NM0031 <sup>2</sup>	SATA 6Gb/s	64MB
2TB	ST2000NM0051 <sup>2,3</sup>	SATA 6Gb/s	64MB
2TB	ST2000NM0001	6Gb/s SAS	64MB
2TB	ST2000NM0021 <sup>2</sup>	6Gb/s SAS	64MB
2TB	ST2000NM0041 <sup>2,3</sup>	6Gb/s SAS	64MB
1TB	ST1000NM0011	SATA 6Gb/s	64MB
1TB	ST1000NM0031 <sup>2</sup>	SATA 6Gb/s	64MB
1TB	ST1000NM0051 <sup>2,3</sup>	SATA 6Gb/s	64MB
1TB	ST1000NM0001	6Gb/s SAS	64MB
1TB	ST1000NM0021 <sup>2</sup>	6Gb/s SAS	64MB
1TB	ST1000NM0041 <sup>2,3</sup>	6Gb/s SAS	64MB
500GB	ST500NM0011	SATA 6Gb/s	64MB
500GB	ST500NM0031 <sup>2</sup>	SATA 6Gb/s	64MB
500GB	ST500NM0051 <sup>2,3</sup>	SATA 6Gb/s	64MB
500GB	ST500NM0001	6Gb/s SAS	64MB
500GB	ST500NM0021 <sup>2</sup>	6Gb/s SAS	64MB
500GB	ST500NM0041 <sup>2,3</sup>	6Gb/s SAS	64MB

# Constellation® ES.2

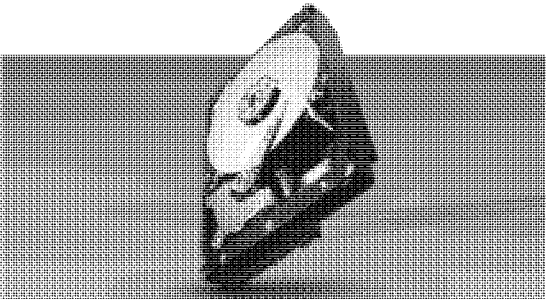
The Seagate Constellation ES.2 drive offers the highest capacities with nearline performance, enterprise-class reliability, high data integrity and data security.

### Key Advantages

- Highest-capacity enterprise drive for demanding data growth
- SAS and SATA drives designed for 24x7 reliability
- Best-in-class enhanced rotational vibration tolerance
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- High-capacity bulk-data storage
- Mainstream enterprise external storage arrays
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance
- Cloud storage



CAPACITY	MODEL	INTERFACE	CACHE
3TB	ST33000650NS	SATA 6Gb/s	64MB
3TB	ST33000651NS <sup>2</sup>	SATA 6Gb/s	64MB
3TB	ST33000652NS <sup>2,3</sup>	SATA 6Gb/s	64MB
3TB	ST33000650SS	6Gb/s SAS	64MB
3TB	ST33000651SS <sup>2</sup>	6Gb/s SAS	64MB
3TB	ST33000652SS <sup>2,3</sup>	6Gb/s SAS	64MB
2TB	ST32000645NS	SATA 6Gb/s	64MB
2TB	ST32000646NS <sup>2</sup>	SATA 6Gb/s	64MB
2TB	ST32000647NS <sup>2,3</sup>	SATA 6Gb/s	64MB
2TB	ST32000645SS	6Gb/s SAS	64MB
2TB	ST32000646SS <sup>2</sup>	6Gb/s SAS	64MB
2TB	ST32000647SS <sup>2,3</sup>	6Gb/s SAS	64MB

<sup>1</sup>One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup>Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup>See FIPS 140-2 Level 2 Certificate at <https://csrc.nist.gov/groups/ST/workshop/documents/f140-1/1401vend.htm>

Constellation.2™

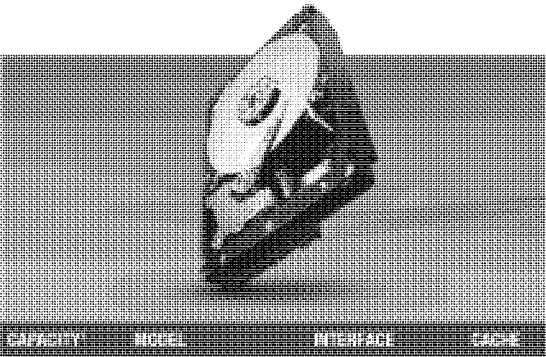
The Seagate Constellation.2 drive is the only 2.5-inch enterprise-class hard drive delivering both 1TB capacities and enterprise reliability.

Key Advantages

- Maximizes data center footprint with up to 76TB/sq.ft.
- Energy-efficient storage at under 3.9W (idle)
- Highest nearline reliability with an MTBF of 1.4M hours
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data.
- FIPS options meet government encryption compliance standards.

Best-Fit Applications

- Storage-hungry business applications
- Storage area networks and network attached storage
- Maximum-capacity servers and blade servers
- Rich media content storage
- Enterprise backup and restore—D2D, virtual tape
- Cloud computing



CAPACITY	MODEL	INTERFACE	CELL
1TB	ST91000640NS	SATA 6Gb/s	64MB
1TB	ST91000641NS <sup>2</sup>	SATA 6Gb/s	64MB
1TB	ST91000642NS <sup>2,3</sup>	SATA 6Gb/s	64MB
1TB	ST91000640SS	6Gb/s SAS	64MB
1TB	ST91000641SS <sup>2</sup>	6Gb/s SAS	64MB
1TB	ST91000642SS <sup>2,3</sup>	6Gb/s SAS	64MB
500GB	ST9500620NS	SATA 6Gb/s	64MB
500GB	ST9500621NS <sup>2</sup>	SATA 6Gb/s	64MB
500GB	ST9500622NS <sup>2,3</sup>	SATA 6Gb/s	64MB
500GB	ST9500620SS	6Gb/s SAS	64MB
500GB	ST9500621SS <sup>2</sup>	6Gb/s SAS	64MB
500GB	ST9500622SS <sup>2,3</sup>	6Gb/s SAS	64MB
250GB	ST9250610NS	SATA 6Gb/s	64MB
250GB	ST9250611NS <sup>2</sup>	SATA 6Gb/s	64MB
250GB	ST9250612NS <sup>2,3</sup>	SATA 6Gb/s	64MB

Pulsar® XT.2

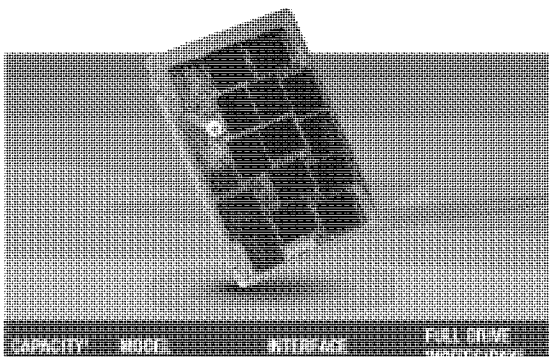
The Seagate Pulsar XT.2 SSD delivers the highest levels of performance, data integrity and drive endurance for the most demanding environments.

Key Advantages

- Consistent high performance for complex, I/O intensive, mixed workload enterprise environments
- Fastest random write performance available in a small form factor, SAS-based SSD
- Ultra-high endurance (supports over 35 full drive writes/day)
- Advanced media-management technology helps protect against unexpected data change or loss
- Self-Encrypting Drive (SED)<sup>2</sup> option (400GB only)

Best-Fit Applications

- Tier 0, external storage arrays
- Performance-hungry, write-intensive enterprise applications
- Blade servers, general servers and direct-attached storage
- Enterprise architectures that use auto-tiering solutions



CAPACITY	MODEL	INTERFACE	FULL DRIVE WRITES/DAY
400GB	ST400FX0002	6Gb/s SAS	35
400GB	ST400FX0012 <sup>2</sup>	6Gb/s SAS	35
200GB	ST200FX0002	6Gb/s SAS	35
100GB	ST100FX0002	6Gb/s SAS	35

Pulsar.2™

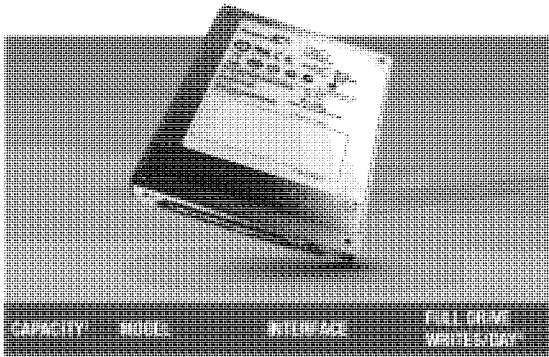
The Seagate Pulsar.2 drive delivers the price-performance, data integrity and endurance benefits for performance-hungry enterprise applications.

Key Advantages

- Best-in-class MLC endurance (up to 10 full drive writes/day)
- Price-performance and reliability benefits
- Protects against unintended data change or loss—ensuring data integrity
- Provides the same feature set to look, feel and act like an enterprise hard drive—reducing system complexity and operating costs

Best-Fit Applications

- Tier 0, performance-hungry enterprise applications—virtualization, OLTP, data warehousing and cloud computing
- Blade servers, general servers and direct-attached storage
- Enterprise architectures using auto-tiering



CAPACITY	MODEL	INTERFACE	FULL DRIVE WRITES/DAY
800GB	ST800FM0002	6Gb/s SAS	10
800GB	ST800FM0012 <sup>2</sup>	6Gb/s SAS	10
400GB	ST400FM0002	6Gb/s SAS	10
400GB	ST400FM0012	SATA 6Gb/s	10
200GB	ST200FM0002	6Gb/s SAS	10
200GB	ST200FM0012	SATA 6Gb/s	10
100GB	ST100FM0002	6Gb/s SAS	10
100GB	ST100FM0012	SATA 6Gb/s	10

<sup>1</sup>One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup>Self-Encrypting Drive models may require TCG-compliant host or controller support.  
<sup>3</sup>See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/comp/documents/140-1/1401vend.htm>.  
<sup>4</sup>Data provided is based on format at 512 bytes.

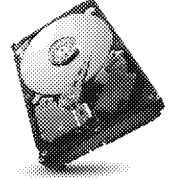


# Video Storage Solutions

## Storage solutions for DVRs and surveillance systems

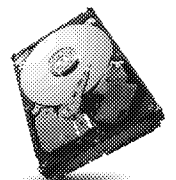
Seagate has the global presence to provide the supply and support for CE integrators as well as a complete business and technology partnership for the video storage market.

## Product Comparison



	PIPELINE HD®	SV35 SERIES™
Application	Mainstream CE-DVR	Video Surveillance
Description	Cool, quiet, low-power performance—perfect for high-definition consumer DVR applications	Optimized performance, power savings and improved reliability for video surveillance applications
Form Factor	3.5-inch	3.5-inch
Performance	Multi-room video delivery of at least ten simultaneous HD streams	7200 RPM
Reliability (AFR)	0.55%	<1%
Max. Ext. Transfer Rate	300MB/s to 600MB/s	600MB/s
Capacity <sup>1</sup>	250GB to 2TB	1TB to 3TB
Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 6Gb/s
Cache	8MB to 64MB	64MB
Power (Idle)	2.5W to 4.5W	3.36W to 5.4W

## Feature Comparison



	3.5-Inch CE-DVR	Video Surveillance
	Pipeline HD	SV35 Series
Application	Pipeline HD	SV35 Series
SATA Interface	x	x
Low Power	x	
Quiet Acoustics	x	
Cool Operation	x	x
Sustainable Technology	x	
Best-in-Class Performance	x	x
Capacity Leadership	x	
24x7 Operation Capable	x	x
Extremely Low Vibration	x	

<sup>1</sup>One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

# Pipeline HD®

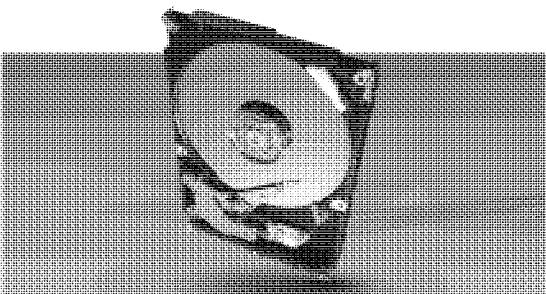
Seagate Pipeline HD drives deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

## Key Advantages

- Virtually silent streaming performance as low as 19dB
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

## Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes



CAPACITY	MODEL	INTERFACE	CACHE
2TB	ST2000VM002	SATA 3Gb/s	64MB
1.5TB	ST1500VM002	SATA 3Gb/s	64MB
1TB	ST1000VM002	SATA 3Gb/s	64MB
500GB	ST3500312CS	SATA 3Gb/s	8MB
320GB	ST3320311CS	SATA 3Gb/s	8MB
250GB	ST3250312CS	SATA 3Gb/s	8MB

# Partner Resources and Benefits

The Seagate Partner Program (SPP) provides access to unique resources and benefits to help channel partners secure new opportunities and grow revenue and profitability.

As a registered SPP member, you enjoy the following exclusive features:

- Password-protected portal
- E-newsletter and regular news updates
- New product evaluation unit program
- Training and sales tools
- Priority support

Start reaping the rewards of SPP membership—register today at [www.seagate.com/partners](http://www.seagate.com/partners)

- Complete the online form.
- Click through and accept our standard agreement.

# SV35 Series™

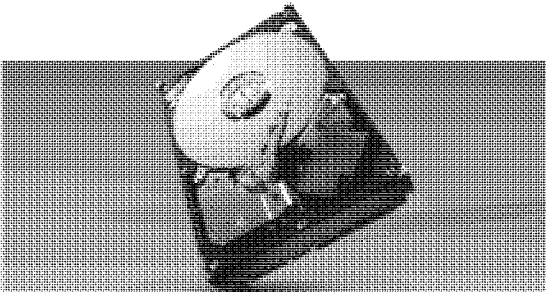
The Seagate SV35 series drives optimize performance, save power and improve reliability for video surveillance applications.

## Key Advantages

- Higher areal density for cost-effective DVR applications
- Performance-tuned for seamless video applications
- Enterprise-class reliability for 24x7 video surveillance applications
- Built-in error recovery for non-stop streaming

## Best-Fit Applications

- Video surveillance digital video recorder
- Video surveillance network digital video recorder
- Direct-attached JBOD video surveillance storage
- Network-attached JBOD video storage



CAPACITY	MODEL	INTERFACE	CACHE
3TB	ST3000VX000	SATA 6Gb/s	64MB
2TB	ST2000VX000	SATA 6Gb/s	64MB
1TB	ST1000VX000	SATA 6Gb/s	64MB

# Service and Support

For information regarding products and services, visit [www.seagate.com/about/contact-us/technical-support](http://www.seagate.com/about/contact-us/technical-support)

Available services include:

- Presales and Technical Support
- Global Support Services telephone numbers and business hours
- Authorized Seagate Service Centers

For information regarding Warranty Support, visit [www.seagate.com/support/warranty-and-returns](http://www.seagate.com/support/warranty-and-returns)

For information regarding Data Recovery Services, visit [services.seagate.com](http://services.seagate.com)

For Seagate OEM and Distribution partner portal, visit [www.seagate.com/partners](http://www.seagate.com/partners)

For Seagate reseller portal, visit [www.seagate.com/partners](http://www.seagate.com/partners)



**Seagate Technology LLC**  
10200 South De Anza Boulevard  
Cupertino, California 95014  
408-658-1000

## Exhibit 27

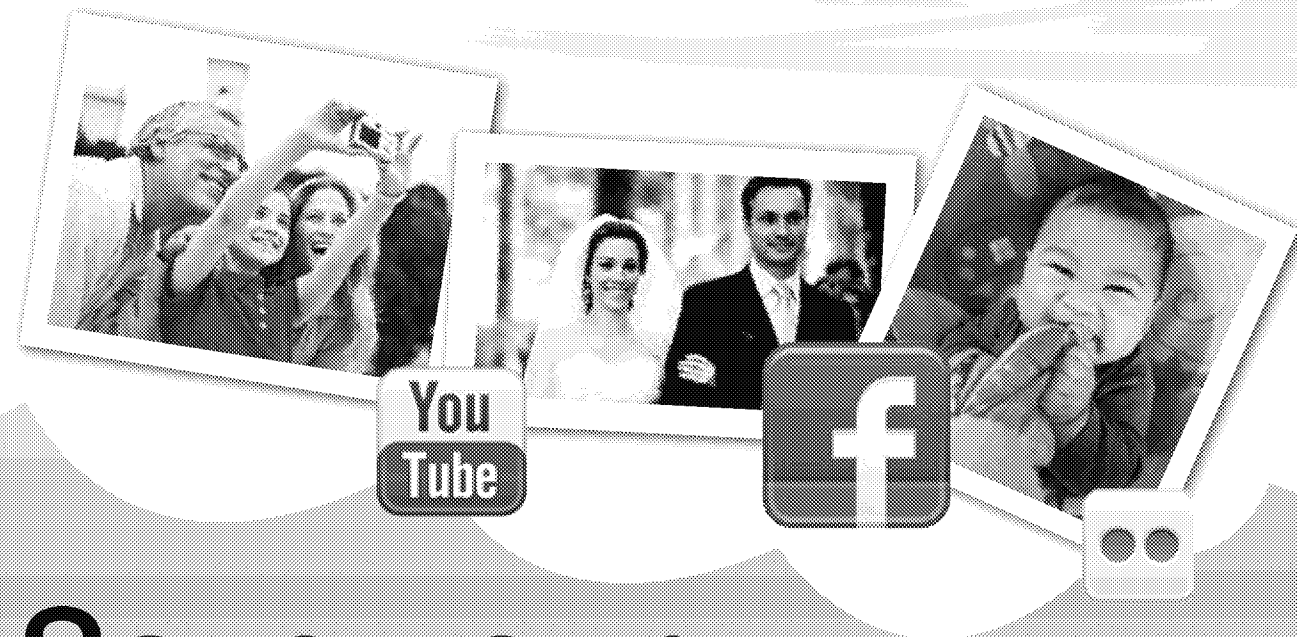


# Storage Solutions Guide

JULY 2012 | AMER







# Save your social life.

Protect your online photos and more with **Backup Plus** drives.



[www.seagate.com](http://www.seagate.com)

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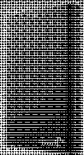
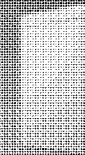
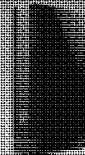
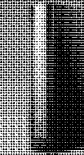
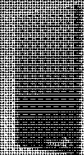
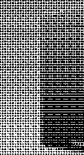
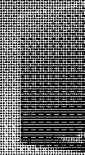
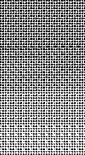
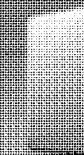
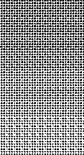

### Internal Storage Solutions


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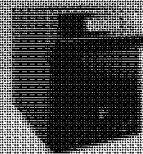
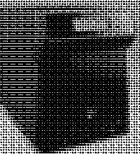
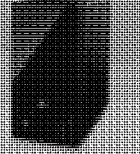


# External Storage

## At-a-Glance Product Comparison

Direct Attached/ Portable	BACKUP PLUS				SLIM		EXPANSION™		GOFLEX™		
											
	Backup Plus Portable	Backup Plus Portable for Mac	Backup Plus Desktop	Backup Plus Desktop for Mac	Slim Portable	Slim Portable for Mac	Expansion Portable	Expansion Desktop	GoFlex for Mac	GoFlex Pro for Mac	GoFlex Slim for Mac
PERFECT FOR	Protecting and sharing digital memories		Keeping your digital life safe and sound		Thin storage that fits—and goes—anywhere		Protecting and sharing your digital life		Compact storage on-the-go		Sleek, high-performance storage
DESCRIPTION	Store and back up the content on your social networks with these flexible, portable drives. PC or Mac.		These desktop drives provide the simple, one-click way to protect and share files. PC or Mac.		This ultra-thin metal design is the world's sleekest portable external hard drive. PC or Mac.		Expansion drives allow you to instantly add more storage space to your computer and take large files with you.		These ultra-portable, ultra-upgradable drives make it easy to store and protect all your files, automatically and continuously. PC or Mac.		A sleek design and Time Machine compatibility, no high-performance portable hard drive is slimmer. PC or Mac.
LEARN MORE	Page 5	Page 6	Page 6	Page 7	Page 7	Page 8	Page 8	Page 9	Page 10	Page 10	Page 11

Wireless Mobile	<div><div>GOFLEX</div><div></div><div>GoFlex Satellite™</div></div>	
	PERFECT FOR	Wireless storage for your tablet
DESCRIPTION	Take your media library on the go and stream it wirelessly to your iPad, Android tablet and smartphone. PC or Mac.	
	LEARN MORE	Page 9

Network Attached	<div><div>GOFLEX</div><div></div><div>GoFlex Home</div></div>	<div><div>BLACKARMOR™</div><div></div><div>BlackArmor NAS 440</div></div>	<div><div>BLACKARMOR™</div><div></div><div>BlackArmor NAS 400</div></div>	<div><div>BLACKARMOR™</div><div></div><div>BlackArmor NAS 220</div></div>	
	PERFECT FOR	Wireless centralized home storage	Full-system backup, RAID 0, 1, 5, 10 or JBOD		Full-system backup, RAID 0 or 1
DESCRIPTION	This network storage system supports the external storage needs of every computer in your home. PC or Mac.		A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations.		A network attached storage solution designed to provide centralized storage and data backup.
	LEARN MORE	Page 11	Page 12	Page 12	Page 13

## Backup Plus

The Backup Plus portable drive is the simple way to protect and share your entire digital life.

### Key Advantages

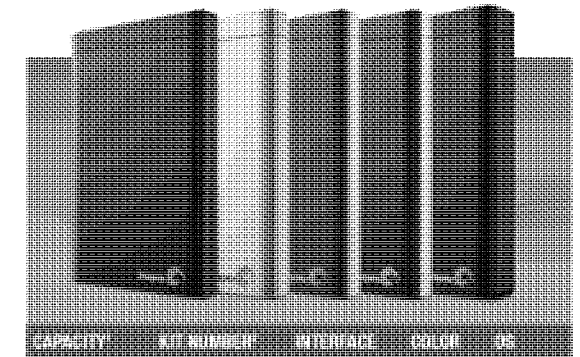
- Easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Thunderbolt technology or FireWire 800 upgrade allows higher transfer speeds

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.

# External Storage Solutions

Seagate external storage solutions are sleek, dependable and ultra-portable products that let your customers automatically and continuously store digital family photos, protect critical business data, back up multiple computers on a small network, or share and store videos and music.



CAPACITY	ST NUMBER	INTERFACE	COLOR	OS
1TB	STBU1000100	USB 3.0	● Black	PC, Mac
1TB	STBU1000101	USB 3.0	◆ Silver	PC, Mac
1TB	STBU1000102	USB 3.0	● Blue	PC, Mac
1TB	STBU1000103	USB 3.0	● Red	PC, Mac
750GB	STBU750100	USB 3.0	● Black	PC, Mac
500GB	STBU500100	USB 3.0	● Black	PC, Mac
500GB	STBU500101	USB 3.0	◆ Silver	PC, Mac
500GB	STBU500102	USB 3.0	● Blue	PC, Mac
500GB	STBU500103	USB 3.0	● Red	PC, Mac
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.54-in D (132mm x 46mm x 166mm)			



<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.

# Backup Plus for Mac

The Backup Plus portable drive for Mac is the simple way to protect and share your entire digital life.

### Key Advantages

- Mac OS and Time-Machine ready out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click.
- Easily increase transfer speeds by upgrading to Thunderbolt technology.

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.

CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
1TB	STBW1000100	USB 2.0	● Silver/ ○ White	Mac, PC
500GB	STBW500100	USB 2.0	● Silver/ ○ White	Mac, PC
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.54-in D (132mm x 46mm x 166mm)			

# Backup Plus Desktop for Mac

The Backup Plus desktop drive for Mac is the simple, one-click way to protect and share your entire digital life.

### Key Advantages

- Mac OS and Time Machine ready right out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click.
- Up to 4TB capacity for a lifetime of memories

### Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.

CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STCB4000100	FireWire 800/ USB 2.0	● Black/ ● Silver	Mac, PC
3TB	STCB3000100	FireWire 800/ USB 2.0	● Black/ ● Silver	Mac, PC
2TB	STCB2000100	FireWire 800/ USB 2.0	● Black/ ● Silver	Mac, PC
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

# Backup Plus Desktop

The Backup Plus desktop drive is the simple, one-click way to protect and share your entire digital life.

### Key Advantages

- Easy, flexible, built-in backup options
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Up to 4TB capacity for a lifetime of memories
- Increase transfer speeds by upgrading to Thunderbolt technology or FireWire 800.

### Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.

CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STCA4000100	USB 3.0	● Black	PC, Mac
3TB	STCA3000100	USB 3.0	● Black	PC, Mac
2TB	STCA2000100	USB 3.0	● Black	PC, Mac
1TB	STCA1000100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

# Slim Portable

The Seagate Slim portable drive is our thinnest, sleekest way yet to back up the things that are important to you.

### Key Advantages

- World's slimmest portable external hard drive
- Protects your stuff with easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.

CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
500GB	STCD500100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	4.91-in L x 3.07-in W x 0.35-in D (124.8mm x 78mm x 9mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.52-in D (132mm x 46mm x 165.5mm)			



# Slim Portable for Mac

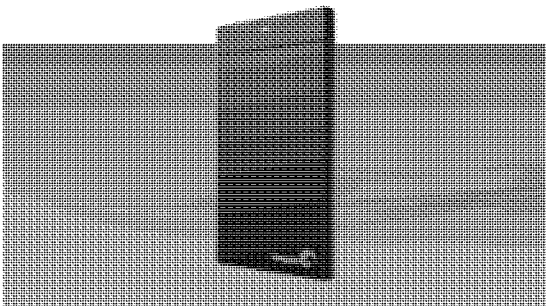
The Seagate Slim portable drive for Mac combines our thinnest, sleekest form factor in a Time Machine-ready drive.

### Key Advantages

- World's slimmest portable external hard drive
- Mac OS and Time Machine ready out of the box
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

### Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.

				
CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STCF500100	USB 2.0	● Black	Mac, PC
PRODUCT DIMENSIONS	4.91-in L x 3.07-in W x 0.35-in D (124.8mm x 78mm x 9mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.52-in D (132mm x 46mm x 165.5mm)			

# Expansion™ Desktop

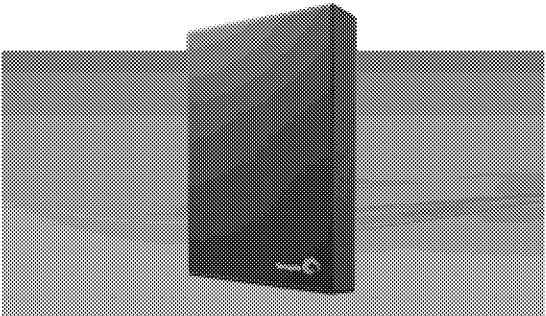
The Expansion desktop drive provides extra storage for your ever-growing collection of files.

### Key Advantages

- Simple and straightforward setup
- No software to install and nothing to configure
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

### Best-Fit Applications

- Instantly add more storage space to your computer.
- Improve performance on your computer's internal drive by freeing up space on your internal drive.

				
CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
3TB	STBV3000100	USB 3.0	● Black	PC
2TB	STBV2000100	USB 3.0	● Black	PC
1TB	STBV1000100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS	7.07-in L x 4.65-in W x 1.48-in D (179.5mm x 118mm x 37.5mm)			
PACKAGE DIMENSIONS	9.09-in L x 7.97-in W x 2.83-in D (231mm x 202mm x 72mm)			

# Expansion™ Portable

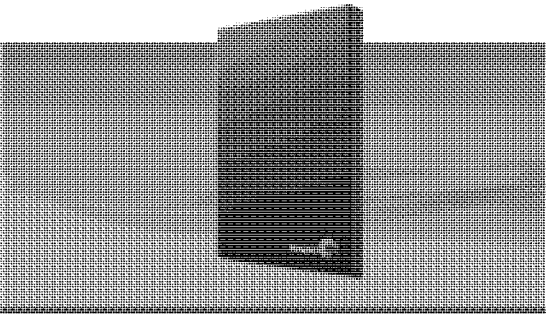
The Expansion portable drive is compact and perfect for taking large files with you on-the-go.

### Key Advantages

- Simple and straightforward setup
- Powered from the USB cable
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

### Best-Fit Applications

- Instantly add more storage space to your computer.
- Take large files with you when you travel.

				
CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1TB	STBX1000100	USB 3.0	● Black	PC
500GB	STBX500100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS (1TB)	5.04-in L x 3.51-in W x 0.87-in D (128.1mm x 89.1mm x 22mm)			
PRODUCT DIMENSIONS (500GB)	4.81-in L x 3.19-in W x 0.61-in D (122.3mm x 81.1mm x 15.5mm)			
PACKAGE DIMENSIONS	5.28-in L x 6.69-in W x 1.89-in D (134mm x 170mm x 48mm)			

# GoFlex Satellite™


With GoFlex Satellite mobile wireless storage, you can take your media library with you. Stream it to your iPad or Android tablet.

### Key Advantages

- Take your media library with you on the go
- Stream media with up to 3 Wi-Fi enabled devices at the same time
- Automatically sync media and documents from your PC or Mac computer
- Up to 5 hours battery life<sup>3</sup>

### Best-Fit Applications

- Store and carry movies and other media on the go.
- Share media with others.
- Works with iPad or Android tablet

				
CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STBF500101	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	4.72-in L x 3.54-in W x 0.87-in D (120mm x 90mm x 22mm)			
PACKAGE DIMENSIONS	6.30-in L x 6.69-in W x 2.13-in D (160mm x 170mm x 54mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> U.S. model numbers shown.  
<sup>3</sup> Exact battery life subject to product model, normal usage conditions and configurations.

# GoFlex® for Mac

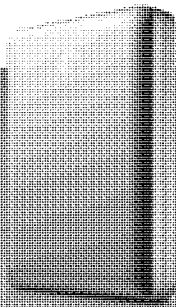
The GoFlex for Mac ultra-portable drive makes it ultra-easy to store, back up and retrieve files on-the-go from your Mac computer.

## Key Advantages

- Delivers plug-and-play connectivity with FireWire 800 or USB 2.0
- Time Machine software compatibility
- Makes it easy for you to upgrade to USB 3.0 and powered eSATA
- Use the same drive on both Mac and PC.

## Best-Fit Applications

- Read, write and share files between Mac and PC computers.
- Carry files while on-the-go.
- Store files or back up using Time Machine.

				
CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
1.5TB	STBA1500100	FireWire 800/ USB 2.0	⦿ Silver	Mac, PC
1TB	STBA1000100	FireWire 800/ USB 2.0	⦿ Silver	Mac, PC
500GB	STBA500100	USB 2.0	● Black	Mac, PC
PRODUCT DIMENSIONS (1.5TB, 1TB)	4.71-in L x 3.51-in W x 0.87-in D (120mm x 89mm x 22mm)			
PRODUCT DIMENSIONS (500GB)	4.39-in L x 3.19-in W x 0.57-in D (111mm x 83mm x 14mm)			
PACKAGE DIMENSIONS	6.1-in L x 1.73-in W x 4.69-in D (170mm x 45mm x 160mm)			

# GoFlex® Slim for Mac

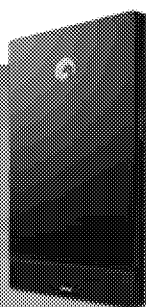
The GoFlex Slim for Mac performance drive has a sleek, ultra-thin enclosure and is Time Machine-ready.

## Key Advantages

- Sleek, ultra-thin anodized design
- Compatible with Time Machine software
- USB 2.0 plug-and-play
- Use the same drive on both Mac and PC computers.

## Best-Fit Applications

- Increase storage capacity for mobile devices.
- Carry files with you anywhere and everywhere.
- Read, write and share files between Mac and PC.

				
CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
500GB	STBL500100	USB 2.0	● Black	Mac, PC
320GB	STBL320100	USB 2.0	● Black	Mac, PC
PRODUCT DIMENSIONS	4.91-in L x 3.07-in W x 0.354-in D (124mm x 78mm x 9mm)			
PACKAGE DIMENSIONS	6.30-in L x 2.56-in W x 4.21-in D (160mm x 65mm x 107mm)			

# GoFlex® Pro for Mac

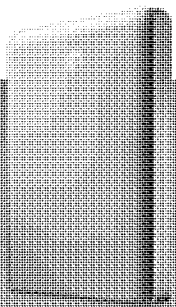
The GoFlex Pro for Mac ultra-portable drive gives you the flexibility you need to extend your digital life wherever you go.

## Key Advantages

- High-performance 7200-RPM drive
- FireWire 800 or USB 2.0 plug-and-play
- Compatible with Time Machine software
- Upgradable to USB 3.0 and powered eSATA
- Use the same drive on both Mac and PC computers

## Best-Fit Applications

- Store files or back up using Time Machine.
- Read, write and share files between Mac and PC.
- Carry files with you on-the-go.

				
CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
750GB	STBB750100	FireWire 800/ USB 2.0	⦿ Silver	Mac, PC
500GB	STBB500100	FireWire 800/ USB 2.0	⦿ Silver	Mac, PC
PRODUCT DIMENSIONS	4.72-in L x 3.46-in W x 0.86-in D (120mm x 88mm x 22mm)			
PACKAGE DIMENSIONS	5.63-in L x 6.3-in W x 2.17-in D (143mm x 160mm x 53mm)			

# GoFlex® Home

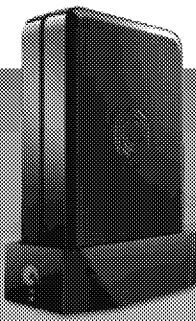
The GoFlex Home network storage system allows you to create secure in-home cloud storage for multiple computers in the home.

## Key Advantages

- Connects to your WiFi router
- Simple setup in just minutes
- Automatic and continuous backup
- Easily update storage capacity or plug in external drives—no tools required.

## Best-Fit Applications

- Back up multiple home PC and Mac computers.
- Store files in a central location.
- Access files from computers and mobile devices over the Internet.
- Stream media to game consoles and media players.
- Share a USB printer with all computers in the home.

				
CAPACITY <sup>1</sup>	KIT NUMBER <sup>2</sup>	INTERFACE	COLOR	OS
3TB	STAM3000100	SATA/GigE	● Black	PC, Mac
2TB	STAM2000100	SATA/GigE	● Black	PC, Mac
1TB	STAM1000100	SATA/GigE	● Black	PC, Mac
PRODUCT DIMENSIONS	3.13-in L x 5.31-in W x 6.75-in D (80mm x 135mm x 171mm)			
PACKAGE DIMENSIONS	10.04-in L x 3.07-in W x 7.64-in D (255mm x 78mm x 194mm)			

# BlackArmor® NAS 440/400

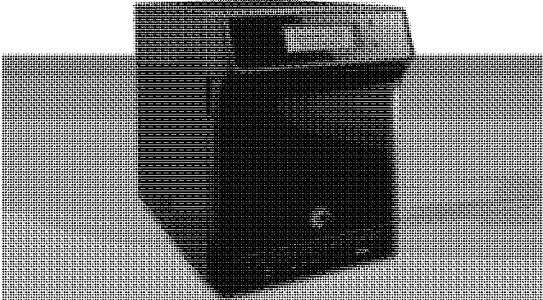
A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations

### Key Advantages

- BlackArmor NAS 440 models include four drives to increase capacity and take advantage of RAID 5/10 options.
- BlackArmor NAS 400 model available without pre-installed drives for maximum flexibility.
- Designed for small business to provide optimum uptime and data integrity
- User-configurable RAID 0/1/5/10 and JBOD
- Continuous and automatic full-system backup for network connected workstations<sup>3</sup>
- Hot-swappable, user-serviceable drives—no tools required

### Best-Fit Applications

- Store and access files from a central, secure location.
- Access and manage files remotely.
- Back up or move files to a secondary storage device.
- Automatically perform full-system backups on network-connect PCs.
- Share a USB printer with network-connected PCs and Macs.
- Encrypt individual files to entire volumes of data.
- Stream media with DLNA or iTunes.



CAPACITY	MODEL#	INTERFACE	COLOR	OS
12TB	STAU12000100	Gigabit Ethernet	● Black	PC, Mac
8TB	ST380005SHA10G-RK	Gigabit Ethernet	● Black	PC, Mac
4TB	ST340005SHA10G-RK	Gigabit Ethernet	● Black	PC, Mac
—	STAR401	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	6.30-in W x 8.15-in H x 10.59-in D (160.00mm x 207.00mm x 269.00mm)			
PACKAGE DIMENSIONS	9.29-in W x 9.50-in H x 14.37-in D (236.00mm x 241.30mm x 365.00mm)			

# BlackArmor® NAS 220

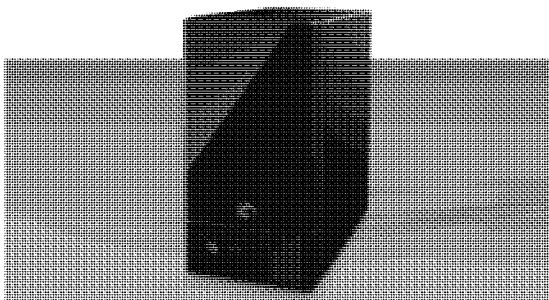
A small-business-specific network attached storage solution designed for centralized storage and data backup for up to 20 PCs

### Key Advantages

- Automatic data mirroring with RAID 1
- Protect network-connected PCs with incremental and full-system, automatic backup<sup>3</sup>
- Functions as FTP server for remote access
- Includes two reliable, user-replaceable drives
- Secure files with hardware-based encryption.

### Best-Fit Applications

- Central, secure file storage and access
- Access and manage files remotely.
- Share a printer with connected PCs and Macs.


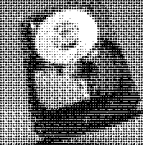










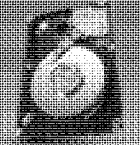




CAPACITY	MODEL#	INTERFACE	COLOR	OS
6TB	STAV6000100	Gigabit Ethernet	● Black	PC, Mac
4TB	ST340005LSA10G-RK	Gigabit Ethernet	● Black	PC, Mac
2TB	ST320005LSA10G-RK	Gigabit Ethernet	● Black	PC, Mac
PRODUCT DIMENSIONS	4.09-in W x 7.79-in H x 7.40-in D (104.00mm x 197.80mm x 188.00mm)			
PACKAGE DIMENSIONS	10.90-in W x 6.13-in H x 11.00-in D (276.86mm x 155.70mm x 279.40mm)			

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to hard drive capacity.  
<sup>2</sup> U.S. model numbers shown.  
<sup>3</sup> Includes 10 software licenses; additional licenses available at [www.seagate.com](http://www.seagate.com)



Internal Storage  
At-a-Glance Product Comparison



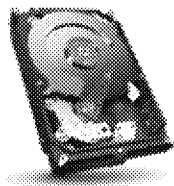
3.5-inch	DESKTOP		ENTERPRISE		ENTERPRISE		VIDEO STORAGE	
								
	Barracuda®	Cheetah® 15K	Constellation® ES.2	Constellation ES	Cheetah NS	SV35 Series™	Pipeline™ HD	
BUSINESS NEED	Mainstream	Performance	Mainstream	Mainstream	Low Power	Surveillance	DVR	
USE THIS DRIVE FOR	Desktop compute where choice in capacity and cache options to provide design flexibility is important	High-capacity, compute-intensive requirements demanding high performance and availability	Bulk-data applications requiring reliable, highest-capacity storage, efficiency and enterprise-class reliability	Maximum-capacity enterprise servers and storage arrays requiring enterprise-class reliability	Mainstream data requiring high capacity, low power and high availability	Surveillance systems that require high performance, low-power, ruggedized and centralized storage for every surveillance application	DVR systems where reliable, low-power, purpose-built storage is required for video streaming applications	
ENCRYPTION MODELS AVAILABLE		X	X	X				
LEARN MORE	Page 18	Page 29	Page 30	Page 31	Page 30	Page 36	Page 36	

2.5-inch	LAPTOP			ENTERPRISE			ENTERPRISE SSD	
								
	Momentus® XT	Momentus	Momentus Thin	Savvio® 15K	Savvio 10K	Constellation 2™	Pulsar® XT.2	Pulsar2™
BUSINESS NEED	Performance	Mainstream	Thin (7mm z-ht.)	Performance	Mainstream	Low Power	Performance	Mainstream
USE THIS DRIVE FOR	The ultimate mobile computing experience, with SSD-like performance for all applications and OS environments	Laptop PCs where the lowest power consumption, silent acoustics and the highest quality is always expected	Slim computing devices such as thin laptops and netbooks, where z-height makes all the difference	Compute-intensive data requirements demanding the highest performance density and availability	Mainstream data requiring high capacity, performance density and reliability	Online reference data demands requiring cost-effective, low-power, enterprise-class drives	Demanding data centers requiring ultra-high performance and the highest levels of data integrity and drive endurance	Enterprise environments requiring MLC-enabled, high-capacity SSD with data integrity and drive endurance
ENCRYPTION MODELS AVAILABLE		X	X	X	X	X	X	X
LEARN MORE	Page 22	Page 23	Page 24	Page 29	Page 28	Page 32	Page 33	Page 33

# Desktop Storage Solutions


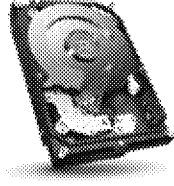
Seagate has a distinguished history in consistently delivering innovative technologies, super-sized capacities, low power and blazing-fast performance. Seagate desktop drives offer excellent performance at all levels.

## Product Comparison

	BARRACUDA® 3.5-INCH INTERNAL KIT	BARRACUDA
Application	Mainstream	Mainstream and Performance
Description	The fast, powerful and easy way to upgrade or add storage capacity to desktop computers	Tuned performance for low-power, mainstream and high-performance desktop computing
Form Factor	3.5 inch	3.5 inch
Performance	7200 RPM	7200 RPM
Reliability (AFR)	<1%	<1%
Max. Ext. Transfer Rate	300MB/s to 600MB/s	600MB/s
Capacity <sup>1</sup>	500GB to 3TB	250GB to 3TB
Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 6Gb/s
Cache	16MB to 64MB	16MB to 64MB
Power (Idle)		3.36W to 7.37W

## Feature Comparison

	MAINSTREAM	MAINSTREAM AND PERFORMANCE
Product	Barracuda 3.5-Inch Internal Kit	Barracuda
SATA Interface	X	X
Sustainable Technology	X	X
Best-in-Class Performance		X
Capacity Leadership	X	X
Quiet Acoustics	X	
DiscWizard™ Installation Software	X	X
Compatible with Windows 7 <sup>2</sup>	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 7, visit <http://www.seagate.com/resources/compatibility/windows-7/en-us/search.aspx?types=Hardware&id=Seagate>

Barracuda®

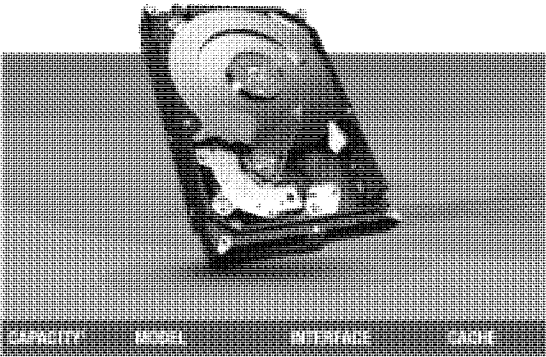
Seagate Barracuda drives give you the Power of One with 1TB-per-disk technology and one drive platform for every capacity and application.

Key Advantages

- Up to 3TB capacity with 7200-RPM performance
- AcuTrac™ and OptiCache™ technologies deliver dependable overall performance.
- Seagate SmartAlign™ technology provides simple migration to Advanced Format 4K sectors.
- Free Seagate DiscWizard™ software

Best-Fit Applications

- Desktop or all-in-one PCs and home servers
- PC-based gaming systems
- Desktop RAID
- Direct-attached external storage devices (DAS)
- Network-attached storage devices (NAS)



CAPACITY	MODEL	INTERFACE	CACHE
3TB	ST3000DM001	SATA 6Gb/s NCQ	64MB
2TB	ST2000DM001	SATA 6Gb/s NCQ	64MB
1.5TB	ST1500DM003	SATA 6Gb/s NCQ	64MB
1TB	ST1000DM003	SATA 6Gb/s NCQ	64MB
750GB	ST750DM003	SATA 6Gb/s NCQ	64MB
500GB	ST500DM002	SATA 6Gb/s NCQ	16MB
320GB	ST320DM000	SATA 6Gb/s NCQ	16MB
250GB	ST250DM000	SATA 6Gb/s NCQ	16MB

Barracuda® 3.5-Inch Internal Kit

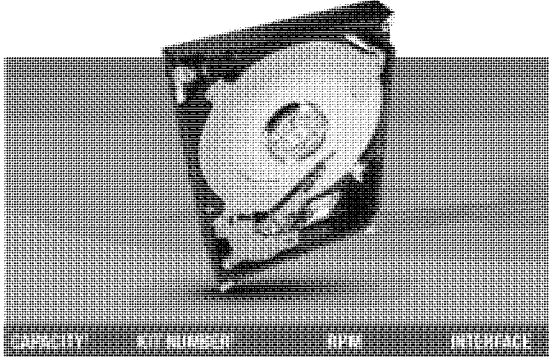
Seagate 3.5-inch internal drives are the fast, powerful, and easy way to upgrade or add storage capacity to desktop computers.

Key Advantages

- Quiet, ultra-high performance
- DiscWizard™ software makes installation a snap
- Built-in self-monitoring technology helps ensure maximum reliability

Best-Fit Applications

- Gaming PCs
- Workstations
- High-end PCs
- Desktop RAID
- Mainstream/office PCs



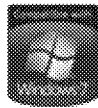
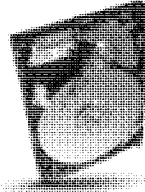
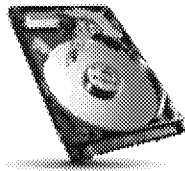
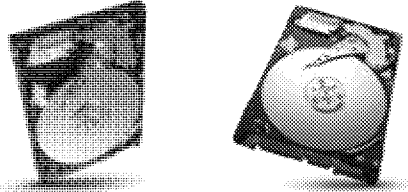
CAPACITY	MODEL	RPM	INTERFACE
3TB	STBD3000100	7200	SATA 6Gb/s
1TB	ST310005N1A1AS-RK	7200	SATA 3Gb/s
500GB	ST3500641AS-RK	7200	SATA 3Gb/s
PACKAGE DIMENSIONS	7.38-in L x 5.88-in W x 2.88-in D (187mm x 149mm x 73mm)		



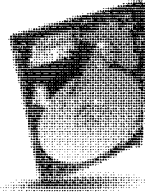
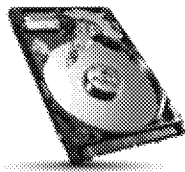
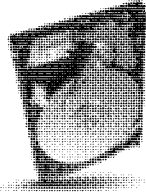

# Laptop Storage Solutions

Seagate laptop drives address every mobile market need, delivering superior performance, reliability and value. Feature-rich with innovative options, the Seagate laptop lineup also includes self-encryption and FIPS 140-2 validated models.

## Product Comparison

				
	MOMENTUS® 2.5-INCH INTERNAL KIT	MOMENTUS XT	MOMENTUS	MOMENTUS THIN
Application	Mainstream and Performance	Extreme Performance	Mainstream	Slim Computing
Description	A complete upgrade kit to transform your system to high performance or just add capacity	Solid state hybrid drives deliver SSD-like performance without sacrificing capacity	The best combination of capacity, mobility and durability in a laptop hard drive	The world's thinnest 2.5-inch drive for slim laptops and netbooks
Form Factor	2.5 inch	2.5 inch	2.5 inch	7mm, 2.5 inch
Performance	5400 RPM to 7200 RPM	7200 RPM	5400 RPM to 7200 RPM	5400 RPM to 7200 RPM
Reliability (AFR)	0.40% to 0.50%	0.50%	0.48% to 0.50%	0.48%
Max. Ext. Transfer Rate	300MB/s	300MB/s to 600MB/s	300MB/s	300MB/s
Capacity <sup>1</sup>	250GB to 750GB	500GB to 750GB	160GB to 750GB	160GB and 300GB
Interface	SATA 3Gb/s	SATA 3Gb/s, SATA 6Gb/s	SATA 3Gb/s	SATA 3Gb/s
Cache	8MB to 32MB	32MB	8MB to 16MB	16MB
Power (Idle)		0.8W to 1.1W	0.5W to 0.81W	0.48% to 0.66%

## Feature Comparison

				
	MAINSTREAM AND PERFORMANCE	EXTREME PERFORMANCE	MAINSTREAM	SLIM COMPUTING
Product	Momentus 2.5-Inch Internal Kit	Momentus XT	Momentus	Momentus Thin
SATA Interface	X	X	X	X
Lowest Acoustics			X	X
Lowest Power			X	X
Self-Encrypting Drive			X	X
Drop Sensor Options			X	
Solid State Hybrid	X	X		
Compatible with Windows 7 <sup>2</sup>	X	X	X	X

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> For a complete list of Seagate products that are compatible with Windows 7, visit <http://www.seagate.com/resources/compatibility/windows-7/en-us/research.aspx?types=Hardware&os=Seagate>

# Momentus® XT

Experience the FAST Factor™ Advantage

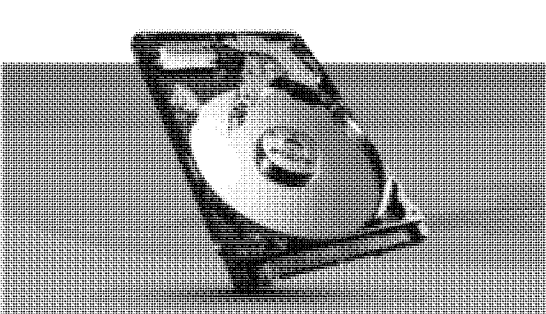
The Seagate Momentus XT solid state hybrid drive enables laptop PC users to enjoy solid state performance without sacrificing capacity.

Key Advantages

- Boots and performs like an SSD<sup>1</sup>
- Up to 3x faster than a traditional HDD<sup>2</sup>
- SATA 6Gb/s with NCQ for interface speed
- All-in-one design for simplicity and ease of installation
- Works in any laptop or PC, any OS and any application
- Backed by a 3-year limited warranty

Best-Fit Applications

- Laptops and mobile workstations
- Desktop and tower workstations
- High-performance laptop and desktop gaming systems
- Small form factor all-in-one PCs



CAPACITY <sup>1</sup>	MODEL	INTERFACE	CACHE
750GB	ST750LX003	SATA 6Gb/s	32MB
500GB	ST95005620AS	SATA 3Gb/s	32MB

# Momentus®

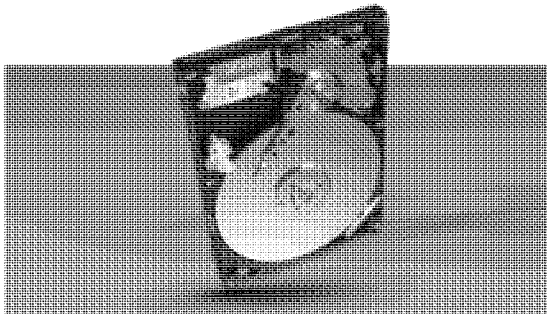
The Seagate Momentus drive offers the world's most feature-rich 2.5-inch family of storage for laptops and external enclosures.

Key Advantages

- Innovative options and features—the power to transform from ordinary to extraordinary
- 7200 RPM delivers a constant high-performance boost.
- 5400 RPM enables affordable, low-power and high-capacity drives for external enclosures.
- Self-Encrypting Drive options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification<sup>4</sup> are government-approved for the U.S. and Canadian governments.
- G-Force Protection™ technology can help keep your data recoverable after a fall, even if your laptop doesn't survive.
- Seagate Smartalign™ technology provides a transition to 4K sectors without the need for software utilities.

Best-Fit Applications

- Mainstream and high-performance laptops
- External storage solutions, boxes
- Industrial applications requiring a small form factor



CAPACITY <sup>1</sup>	5400-RPM MODEL	INTERFACE	CACHE
750GB	ST9750420AS <sup>3</sup>	SATA 3Gb/s	16MB
500GB	ST9500423AS <sup>3</sup>	SATA 3Gb/s	16MB
500GB	ST9500420ASG <sup>2</sup>	SATA 3Gb/s	16MB
500GB	ST9500421AS <sup>5</sup>	SATA 3Gb/s	16MB
500GB	ST9500422AS <sup>5</sup>	SATA 3Gb/s	16MB
320GB	ST9320423AS	SATA 3Gb/s	16MB
320GB	ST320LT023 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250410AS	SATA 3Gb/s	16MB
250GB	ST250LT021 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250410ASG <sup>2</sup>	SATA 3Gb/s	16MB
250GB	ST9250411AS <sup>5</sup>	SATA 3Gb/s	16MB
250GB	ST9250412AS <sup>3,6</sup>	SATA 3Gb/s	16MB
160GB	ST9160412AS	SATA 3Gb/s	16MB
160GB	ST160LT016 <sup>3,4</sup>	SATA 3Gb/s	16MB

CAPACITY <sup>1</sup>	5400-RPM MODEL	INTERFACE	CACHE
750GB	ST9750423AS <sup>3</sup>	SATA 3Gb/s	16MB
640GB	ST9640320AS	SATA 3Gb/s	8MB
500GB	ST9500325AS	SATA 3Gb/s	8MB
500GB	ST9500325ASG <sup>2</sup>	SATA 3Gb/s	8MB
500GB	ST9500327AS <sup>5</sup>	SATA 3Gb/s	8MB
320GB	ST9320325AS	SATA 3Gb/s	8MB
320GB	ST320LT022 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250315AS	SATA 3Gb/s	8MB
250GB	ST250LT020 <sup>3,4</sup>	SATA 3Gb/s	16MB
250GB	ST9250317AS <sup>5</sup>	SATA 3Gb/s	8MB
160GB	ST9160314AS	SATA 3Gb/s	8MB
160GB	ST160LT015 <sup>3,4</sup>	SATA 3Gb/s	16MB

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Drive with G-Force Protection™ feature.  
<sup>3</sup> Advanced Format (4K) drive with SmartAlign™ technology reduces misalignment concerns.  
<sup>4</sup> 7mm 2.5-height expanded to 5.5mm enables compatibility with standard laptop chassis.  
<sup>5</sup> Self-Encrypting Drive model.  
<sup>6</sup> See FIPS 140-2 Level 2 On-line at <http://csrc.nist.gov/groups/STM/scsp/documents/fips-140-2/fips140-2.htm>.  
<sup>7</sup> Performance may vary depending on user's hardware configuration and operating system. Testing performed on a Momentus XT 750GB 5500.

Momentus® Thin

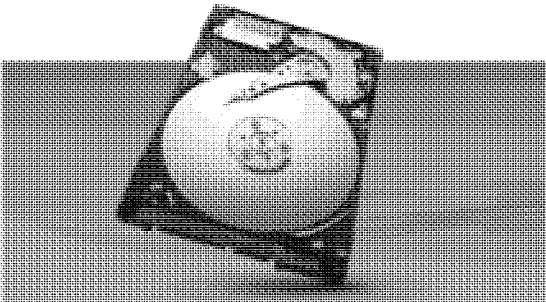
The 7mm, 2.5-inch drive enables slim computing for all types of mobile computing, from laptops to netbooks to smaller desktop PCs.

Key Advantages

- 7mm z-height form factor enables thin chassis design for all segments of laptop computing.
- Seagate SmartAlign™ technology provides a transition to 4K sectors without the need for software utilities.
- Self-Encrypting Drive options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification<sup>3</sup> are government-approved for the U.S. and Canadian governments.

Best-Fit Applications

- Thin entry-level laptop PCs
- Thin high-end netbooks
- Thin ultraportables
- Slim CE devices



CAPACITY <sup>1</sup>	5400-RPM MODEL	INTERFACE	CACHE
320GB	ST320LT007	SATA 3Gb/s	16MB
320GB	ST320LT014 <sup>2</sup>	SATA 3Gb/s	16MB
320GB	ST320LT009 <sup>2,3</sup>	SATA 3Gb/s	16MB
250GB	ST250LT007	SATA 3Gb/s	16MB
250GB	ST250LT014 <sup>2</sup>	SATA 3Gb/s	16MB
250GB	ST250LT009 <sup>2,3</sup>	SATA 3Gb/s	16MB
160GB	ST160LT007	SATA 3Gb/s	16MB

CAPACITY <sup>1</sup>	5400-RPM MODEL	INTERFACE	CACHE
500GB	ST500LT025 <sup>2,4</sup>	SATA 3Gb/s	16MB
500GB	ST500LT015 <sup>3,4</sup>	SATA 3Gb/s	16MB
500GB	ST500LT012	SATA 3Gb/s	16MB
320GB	ST320LT020	SATA 3Gb/s	16MB
320GB	ST320LT012 <sup>4</sup>	SATA 3Gb/s	16MB
250GB	ST250LT003	SATA 3Gb/s	16MB
250GB	ST250LT012 <sup>4</sup>	SATA 3Gb/s	16MB
160GB	ST160LT003	SATA 3Gb/s	16MB

Momentus® 2.5-Inch Internal Kit

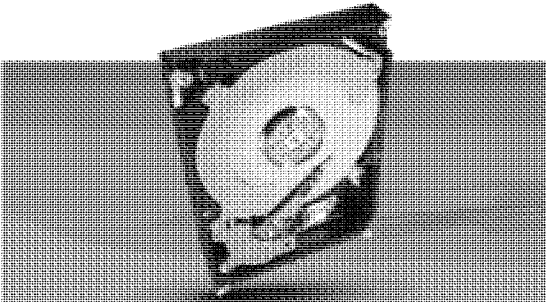
Seagate 2.5-inch internal drives deliver vast amounts of storage for adding capacity or upgrading drives in laptop computers.

Key Advantages

- Built for mobility
- Preserves battery life
- Large data cache
- Outstanding performance
- Momentus XT solid state hybrid model offers SSD-like performance with the capacity of a hard drive.

Best-Fit Applications

- Replacement laptop drives
- Laptop storage upgrades
- High-end laptops and workstations



CAPACITY	SKU NUMBER	RPM	INTERFACE
1TB	STBD1000100	5400	SATA 3Gb/s
750GB	ST907503N1A1AS-RK	7200	SATA 3Gb/s
640GB	ST906403N1A1AS-RK	5400	SATA 3Gb/s
500GB	ST905003N3A1AS-RK	7200	SATA 3Gb/s
500GB	ST905003N1A1AS-RK	5400	SATA 3Gb/s
320GB	ST903203N3A1AS-RK	7200	SATA 3Gb/s
320GB	ST903203N1A2AS-RK	5400	SATA 3Gb/s
250GB	ST90250N1A1AS-RK	5400	SATA 3Gb/s

MOMENTUS XT MODEL			
750GB	STBD750100	7200	SATA 6Gb/s
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		

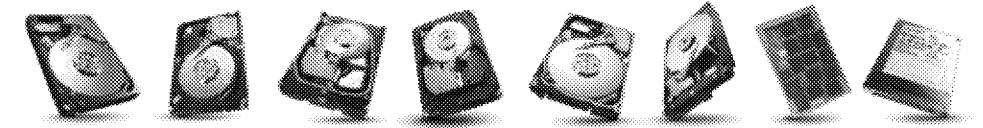
<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup> Self-Encrypting Drive models may require 10G-compliant host or controller support.  
<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/strep/documents/f140-1/f1401vend.htm>.  
<sup>4</sup> SmartAlign technology is not available on this model.  
<sup>5</sup> U.S. model numbers shown.



# Enterprise Storage Solutions

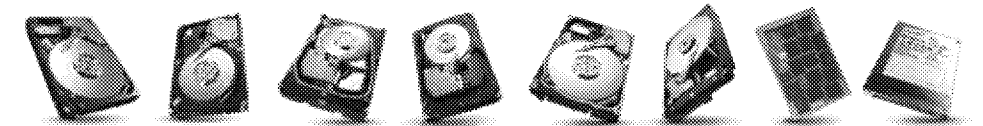
Seagate has the enterprise storage expertise as well as the global presence, processes and resources to consistently support small or medium businesses and run a large data center with the industry's highest-quality enterprise storage products, including FIPS 140-2 validated models.

## Product Comparison



	SAVVIO®	CHEETAH®	CONSTELLATION®	PULSAR®
Application	SFF Performance and Mainstream	LFF Performance and Mainstream	High Capacity and Low Power	Mainstream and Performance SSD
Description	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 2.5-inch form factor	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 3.5-inch form factor	High-capacity, lowest-power, reliable 7200-RPM enterprise hard drive in both 2.5- and 3.5-inch form factors	Performance, data integrity and drive endurance in an enterprise solid state drive
Form Factor	2.5-inch	3.5-inch	2.5-inch and 3.5-inch	2.5-inch
Performance	15K RPM and 10K RPM	15K RPM and 10K RPM	7200 RPM	MLC and SLC
Reliability (AFR)	0.44%	0.55%	0.62% and 0.73%	0.44%
Capacity <sup>1</sup>	146GB to 900GB	300GB to 600GB	250GB to 3TB	100GB to 800GB
Power (Idle)	3.5W to 4.4W	5.6W to 11.68W	2.52W to 7.7W	3.47W to 5.92W
Interface	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, SATA 6Gb/s	6Gb/s SAS, SATA 6Gb/s
Limited Warranty <sup>4</sup>	5 years	5 years	3 years and 5 years	5 years

## Feature Comparison



	2.5-inch Mission Critical		3.5-inch Mission Critical		2.5-inch Nearline	3.5-inch Nearline	Performance SSD	Mainstream SSD
Product	Savvio 15K	Savvio 10K	Cheetah 15K	Cheetah NS	Constellation	Constellation ES	Pulsar XT.2	Pulsar.2
Best-in-Class Performance	X		X		X	X	X	
Capacity Leadership		X	X	X		X		X
Vibration Tolerance for Multi-Drive Stabilization	X	X	X	X	X	X		
6Gb/s SAS Interface	X	X	X	X	X	X	X	X
4Gb/s FC Interface		X	X	X				
6Gb/s SATA Interface					X	X	X	X
Best-in-Class Power Usage		X		X	X	X		
PowerChoice™ Optimized Idle Power Settings		X			X	X		
Self-Encrypting Drive (SED) <sup>2</sup>	X	X	X		X	X	X	X
FIPS 140-2 SED <sup>2,3</sup>	X	X	X		X	X		

<sup>1</sup> One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

<sup>2</sup> Self-Encrypting Drive models may require FIPS-compliant host or controller support.

<sup>3</sup> See FIPS 140-2 Level 2 Certificate at <https://www.seagate.com/usa/enterprise/storage/enterprise-storage/fips-140-2-level-2-certificate>

<sup>4</sup> Warranty terms may vary based on usage. Contact your Seagate sales representative for warranty terms and conditions.

Savvio® 10K

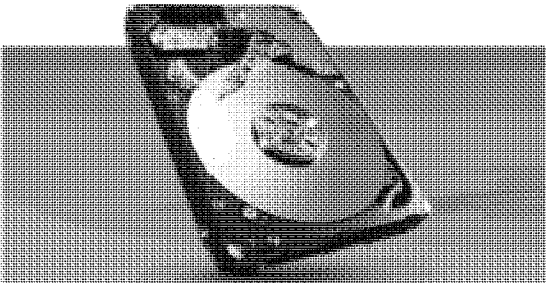
Seagate Savvio 10K drives deliver the optimal balance of capacity, performance and power in a 10K-RPM, 2.5-inch enterprise drive.

Key Advantages

- Highest-capacity enterprise SFF hard drive (up to 900GB)
- PowerChoice™ technology reduces power consumption.
- First SFF 10K-RPM drive to support 4Gb/s FC
- Protection Information (PI) option detects corruption of data in flight between the host system and the drive<sup>4</sup>
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- Mission-critical servers and external storage arrays
- Power- and space-constrained data centers
- Compliance or data security initiatives



CAPACITY	MODEL	INTERFACE	CACHE
900GB	ST9900805SS	6Gb/s SAS	64MB
900GB	ST9900705SS <sup>2</sup>	6Gb/s SAS	64MB
900GB	ST9900605SS <sup>2,3</sup>	6Gb/s SAS	64MB
900GB	ST9900805FC	6Gb/s SAS	64MB
600GB	ST9600205SS	6Gb/s SAS	64MB
600GB	ST9600105SS <sup>2</sup>	6Gb/s SAS	64MB
600GB	ST9600005SS <sup>2,3</sup>	6Gb/s SAS	64MB
600GB	ST9600205FC	6Gb/s SAS	64MB
450GB	ST9450405SS	6Gb/s SAS	64MB
450GB	ST9450305SS <sup>2</sup>	6Gb/s SAS	64MB
450GB	ST9450205SS <sup>2,3</sup>	6Gb/s SAS	64MB
450GB	ST9450405FC	6Gb/s SAS	64MB
300GB	ST9300605SS	6Gb/s SAS	64MB
300GB	ST9300505SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300405SS <sup>2,3</sup>	6Gb/s SAS	64MB
300GB	ST9300605FC	6Gb/s SAS	64MB

Savvio® 15K

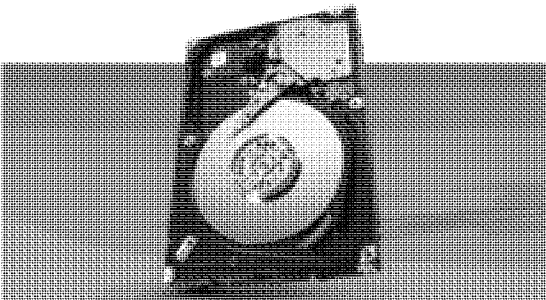
The 2.5-inch Seagate Savvio 15K hard drive provides the world's highest performance and reliability while delivering ultra-low power consumption.

Key Advantages

- Stores twice the amount of Tier 1 data without increasing drive count
- Enables Tier 1 applications to process transactions more quickly
- Reduces system complexity and operating costs
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- High-performance enterprise servers and storage arrays
- Transaction-intensive database applications
- Blade, rack and tower servers
- Security compliance-driven IT organizations



CAPACITY	MODEL	INTERFACE	CACHE
300GB	ST9300653SS	6Gb/s SAS	64MB
300GB	ST9300553SS <sup>2</sup>	6Gb/s SAS	64MB
300GB	ST9300453SS <sup>2,3</sup>	6Gb/s SAS	64MB
146GB	ST9146853SS	6Gb/s SAS	64MB
146GB	ST9146753SS <sup>2</sup>	6Gb/s SAS	64MB
146GB	ST9146653SS <sup>2,3</sup>	6Gb/s SAS	64MB
146GB	ST9146852SS	6Gb/s SAS	16MB
146GB	ST9146752SS <sup>2</sup>	6Gb/s SAS	16MB
146GB	ST9146652SS <sup>2,3</sup>	6Gb/s SAS	16MB
73GB	ST973452SS	6Gb/s SAS	16MB
73GB	ST973352SS <sup>2</sup>	6Gb/s SAS	16MB
73GB	ST973252SS <sup>2,3</sup>	6Gb/s SAS	16MB

Cheetah® 15K

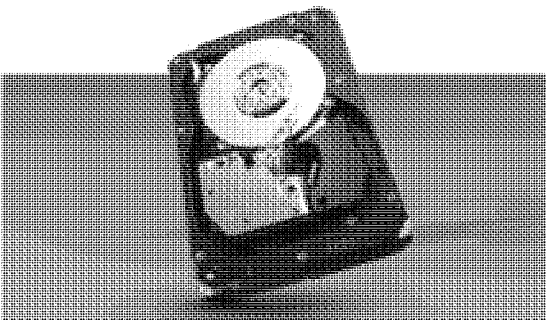
The Seagate Cheetah 15K drive provides the highest capacity, performance and reliability in 3.5-inch mission-critical storage.

Key Advantages

- Third-generation perpendicular recording
- Sustained data rate of up to 204MB/s
- Industry's highest 3.5-inch drive reliability
- Powertrim™ technology optimizes power consumption
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- Business and transaction processing
- Email and decision support
- Storage Area Networks (SAN)
- Network Attached Storage (NAS)
- Internet and e-commerce



CAPACITY	MODEL	INTERFACE	CACHE
600GB	ST3600057SS	6Gb/s SAS	16MB
600GB	ST3600957SS <sup>2</sup>	6Gb/s SAS	16MB
600GB	ST3600857SS <sup>2,3</sup>	6Gb/s SAS	16MB
600GB	ST3600057FC	4Gb/s FC	16MB
450GB	ST3450857SS	6Gb/s SAS	16MB
450GB	ST3450757SS <sup>2</sup>	6Gb/s SAS	16MB
450GB	ST3450657SS <sup>2,3</sup>	6Gb/s SAS	16MB
450GB	ST3450857FC	4Gb/s FC	16MB
300GB	ST3300657SS	6Gb/s SAS	16MB
300GB	ST3300557SS <sup>2</sup>	6Gb/s SAS	16MB
300GB	ST3300457SS <sup>2,3</sup>	6Gb/s SAS	16MB
300GB	ST3300657FC	4Gb/s FC	16MB

<sup>1</sup>One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup>Self-Encrypting Drive models may require TCG-encrypted host or controller support.  
<sup>3</sup>See FIPS 140-2 Level 2 Certificate at <http://csrc.nist.gov/groups/STM/compdocuments/140-1/1402level2.htm>.  
<sup>4</sup>Protection Information (PI) feature requires PI-compliant host or controller support.



# Cheetah® NS

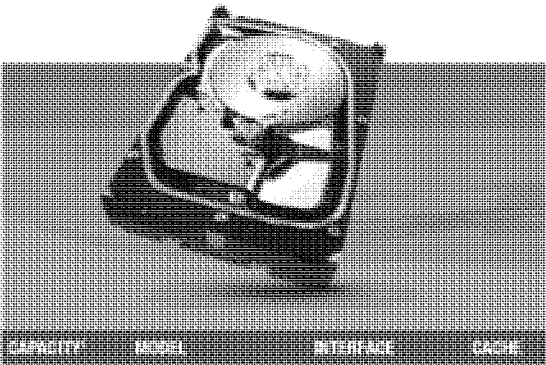
The Seagate Cheetah NS drive delivers the lowest-power, highest-reliability combination for 3.5-inch Tier 1 solutions.

### Key Advantages

- Highest-capacity Tier 1 drive (600GB)
- Highest LFF reliability rating in the industry, with a 0.55% annualized failure rate (AFR)
- Seagate PowerTrim technology dynamically reduces power usage.

### Best-Fit Applications

- Mainstream enterprise applications
- Business and transaction processing
- Storage Area Networks (SAN)
- Network Attached Storage (NAS)



CAPACITY	MODEL	INTERFACE	CACHE
600GB	ST3600002SS	6Gb/s SAS	16MB
600GB	ST3600002FC	4Gb/s FC	16MB
450GB	ST3450802SS	6Gb/s SAS	16MB
450GB	ST3450802FC	4Gb/s FC	16MB
300GB	ST3300602FC	4Gb/s FC	16MB

# Constellation® ES

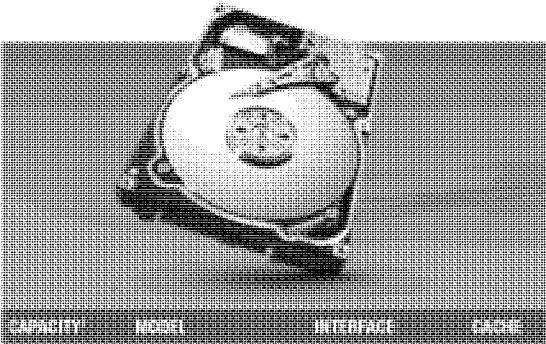
Seagate Constellation ES 3.5-inch hard drives offer the highest capacity at 2TB while providing enterprise robustness for seamless enterprise integration.

### Key Advantages

- Enterprise nearline drive designed for 24x7 operation
- Best-in-class rotational vibration tolerance
- Multi-drive firmware maximizes system availability.
- Optimal power savings with PowerChoice™ technology
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data.
- FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- High-capacity data center storage
- Mainstream enterprise external storage arrays
- Enterprise backup and restore
- Cloud storage



CAPACITY	MODEL	INTERFACE	CACHE
2TB	ST2000NM0011	SATA 6Gb/s	64MB
2TB	ST2000NM0031 <sup>2</sup>	SATA 6Gb/s	64MB
2TB	ST2000NM0051 <sup>2,3</sup>	SATA 6Gb/s	64MB
2TB	ST2000NM0001	6Gb/s SAS	64MB
2TB	ST2000NM0021 <sup>2</sup>	6Gb/s SAS	64MB
2TB	ST2000NM0041 <sup>2,3</sup>	6Gb/s SAS	64MB
1TB	ST1000NM0011	SATA 6Gb/s	64MB
1TB	ST1000NM0031 <sup>2</sup>	SATA 6Gb/s	64MB
1TB	ST1000NM0051 <sup>2,3</sup>	SATA 6Gb/s	64MB
1TB	ST1000NM0001	6Gb/s SAS	64MB
1TB	ST1000NM0021 <sup>2</sup>	6Gb/s SAS	64MB
1TB	ST1000NM0041 <sup>2,3</sup>	6Gb/s SAS	64MB
500GB	ST500NM0011	SATA 6Gb/s	64MB
500GB	ST500NM0031 <sup>2</sup>	SATA 6Gb/s	64MB
500GB	ST500NM0051 <sup>2,3</sup>	SATA 6Gb/s	64MB
500GB	ST500NM0001	6Gb/s SAS	64MB
500GB	ST500NM0021 <sup>2</sup>	6Gb/s SAS	64MB
500GB	ST500NM0041 <sup>2,3</sup>	6Gb/s SAS	64MB

# Constellation® ES.2

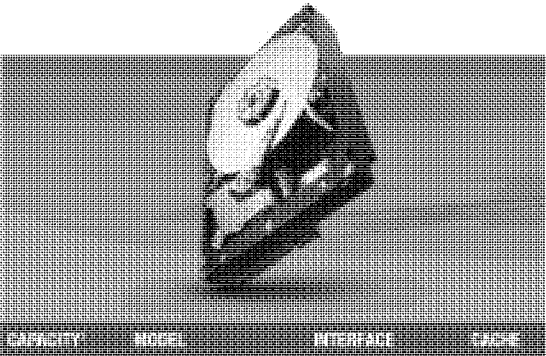
The Seagate Constellation ES.2 drive offers the highest capacities with nearline performance, enterprise-class reliability, high data integrity and data security.

### Key Advantages

- Highest-capacity enterprise drive for demanding data growth
- SAS and SATA drives designed for 24x7 reliability
- Best-in-class enhanced rotational vibration tolerance
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

### Best-Fit Applications

- High-capacity bulk-data storage
- Mainstream enterprise external storage arrays
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance
- Cloud storage



CAPACITY	MODEL	INTERFACE	CACHE
3TB	ST33000650NS	SATA 6Gb/s	64MB
3TB	ST33000651NS <sup>2</sup>	SATA 6Gb/s	64MB
3TB	ST33000652NS <sup>2,3</sup>	SATA 6Gb/s	64MB
3TB	ST33000650SS	6Gb/s SAS	64MB
3TB	ST33000651SS <sup>2</sup>	6Gb/s SAS	64MB
3TB	ST33000652SS <sup>2,3</sup>	6Gb/s SAS	64MB
2TB	ST32000645NS	SATA 6Gb/s	64MB
2TB	ST32000646NS <sup>2</sup>	SATA 6Gb/s	64MB
2TB	ST32000647NS <sup>2,3</sup>	SATA 6Gb/s	64MB
2TB	ST32000645SS	6Gb/s SAS	64MB
2TB	ST32000646SS <sup>2</sup>	6Gb/s SAS	64MB
2TB	ST32000647SS <sup>2,3</sup>	6Gb/s SAS	64MB

<sup>1</sup>One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup>Self-Encrypting Drive models may require TCG-encrypted host or controller support.  
<sup>3</sup>See FIPS 140-2 Level 2 Certificate at <https://www.fips.gov/documents/140-2/1401-validated.htm>

Constellation.2™

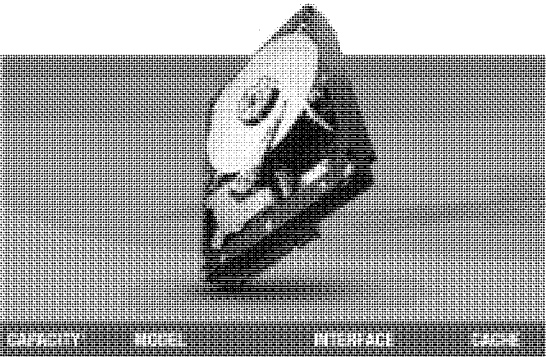
The Seagate Constellation.2 drive is the only 2.5-inch enterprise-class hard drive delivering both 1TB capacities and enterprise reliability.

Key Advantages

- Maximizes data center footprint with up to 76TB/sq.ft.
- Energy-efficient storage at under 3.9W (idle)
- Highest nearline reliability with an MTBF of 1.4M hours
- Self-Encrypting Drive (SED)<sup>2</sup> and FIPS 140-2 certified SED<sup>3</sup> cut IT drive retirement costs and protect data.
- FIPS options meet government encryption compliance standards.

Best-Fit Applications

- Storage-hungry business applications
- Storage area networks and network attached storage
- Maximum-capacity servers and blade servers
- Rich media content storage
- Enterprise backup and restore—D2D, virtual tape
- Cloud computing



CAPACITY	MODEL	INTERFACE	CACHE
1TB	ST91000640NS	SATA 6Gb/s	64MB
1TB	ST91000641NS <sup>2</sup>	SATA 6Gb/s	64MB
1TB	ST91000642NS <sup>2,3</sup>	SATA 6Gb/s	64MB
1TB	ST91000640SS	6Gb/s SAS	64MB
1TB	ST91000641SS <sup>2</sup>	6Gb/s SAS	64MB
1TB	ST91000642SS <sup>2,3</sup>	6Gb/s SAS	64MB
500GB	ST9500620NS	SATA 6Gb/s	64MB
500GB	ST9500621NS <sup>2</sup>	SATA 6Gb/s	64MB
500GB	ST9500622NS <sup>2,3</sup>	SATA 6Gb/s	64MB
500GB	ST9500620SS	6Gb/s SAS	64MB
500GB	ST9500621SS <sup>2</sup>	6Gb/s SAS	64MB
500GB	ST9500622SS <sup>2,3</sup>	6Gb/s SAS	64MB
250GB	ST9250610NS	SATA 6Gb/s	64MB
250GB	ST9250611NS <sup>2</sup>	SATA 6Gb/s	64MB
250GB	ST9250612NS <sup>2,3</sup>	SATA 6Gb/s	64MB

Pulsar® XT.2

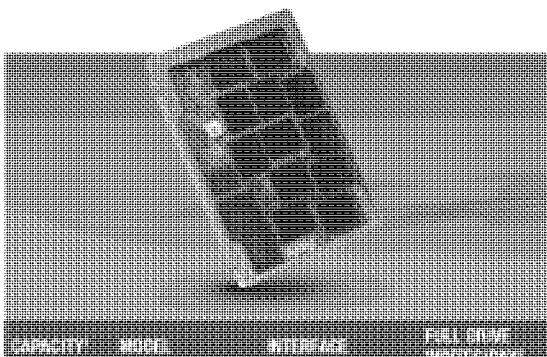
The Seagate Pulsar XT.2 SSD delivers the highest levels of performance, data integrity and drive endurance for the most demanding environments.

Key Advantages

- Consistent high performance for complex, I/O intensive, mixed workload enterprise environments
- Fastest random write performance available in a small form factor, SAS-based SSD
- Ultra-high endurance (supports over 35 full drive writes/day)
- Advanced media-management technology helps protect against unexpected data change or loss
- Self-Encrypting Drive (SED)<sup>2</sup> option (400GB only)

Best-Fit Applications

- Tier 0, external storage arrays
- Performance-hungry, write-intensive enterprise applications
- Blade servers, general servers and direct-attached storage
- Enterprise architectures that use auto-tiering solutions



CAPACITY	MODEL	INTERFACE	FULL DRIVE WRITES/DAY
400GB	ST400FX0002	6Gb/s SAS	35
400GB	ST400FX0012 <sup>2</sup>	6Gb/s SAS	35
200GB	ST200FX0002	6Gb/s SAS	35
100GB	ST100FX0002	6Gb/s SAS	35

Pulsar.2™

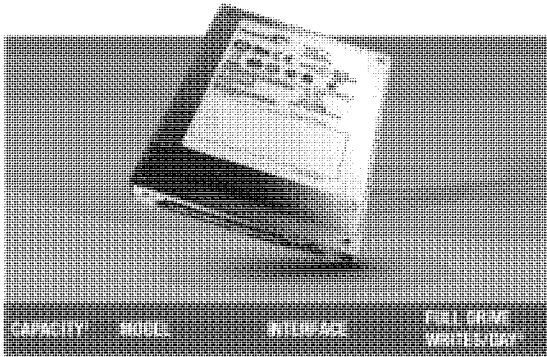
The Seagate Pulsar.2 drive delivers the price-performance, data integrity and endurance benefits for performance-hungry enterprise applications.

Key Advantages

- Best-in-class MLC endurance (up to 10 full drive writes/day)
- Price-performance and reliability benefits
- Protects against unintended data change or loss—ensuring data integrity
- Provides the same feature set to look, feel and act like an enterprise hard drive—reducing system complexity and operating costs

Best-Fit Applications

- Tier 0, performance-hungry enterprise applications—virtualization, OLTP, data warehousing and cloud computing
- Blade servers, general servers and direct-attached storage
- Enterprise architectures using auto-tiering



CAPACITY	MODEL	INTERFACE	FULL DRIVE WRITES/DAY
800GB	ST800FM0002	6Gb/s SAS	10
800GB	ST800FM0012 <sup>2</sup>	6Gb/s SAS	10
400GB	ST400FM0002	6Gb/s SAS	10
400GB	ST400FM0012	SATA 6Gb/s	10
200GB	ST200FM0002	6Gb/s SAS	10
200GB	ST200FM0012	SATA 6Gb/s	10
100GB	ST100FM0002	6Gb/s SAS	10
100GB	ST100FM0012	SATA 6Gb/s	10

<sup>1</sup>One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.  
<sup>2</sup>Self-Encrypting Drive models may require TCG-Opal-compliant host or controller support.  
<sup>3</sup>See FIPS 140-2 Level 2 Certification at <http://csrc.nist.gov/groups/STM/transparencystudies/140-1/1402level2.htm>.  
<sup>4</sup>Data provided is based on format at 512 bytes.

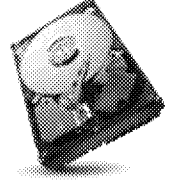


# Video Storage Solutions

## Storage solutions for DVRs and surveillance systems

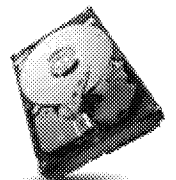
Seagate has the global presence to provide the supply and support for CE integrators as well as a complete business and technology partnership for the video storage market.

## Product Comparison



	PIPELINE HD®	SV35 SERIES™
Application	Mainstream CE-DVR	Video Surveillance
Description	Cool, quiet, low-power performance—perfect for high-definition consumer DVR applications	Optimized performance, power savings and improved reliability for video surveillance applications
Form Factor	3.5-inch	3.5-inch
Performance	Multi-room video delivery of at least ten simultaneous HD streams	7200 RPM
Reliability (AFR)	0.55%	<1%
Max. Ext. Transfer Rate	300MB/s to 600MB/s	600MB/s
Capacity <sup>1</sup>	250GB to 2TB	1TB to 3TB
Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 6Gb/s
Cache	8MB to 64MB	64MB
Power (Idle)	2.5W to 4.5W	3.36W to 5.4W

## Feature Comparison



	3.5-Inch CE-DVR	Video Surveillance
	Pipeline HD	SV35 Series
Application		
SATA Interface	x	x
Low Power	x	
Quiet Acoustics	x	
Cool Operation	x	x
Sustainable Technology	x	
Best-in-Class Performance	x	x
Capacity Leadership	x	
24x7 Operation Capable	x	x
Extremely Low Vibration	x	

<sup>1</sup>One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

Pipeline HD®

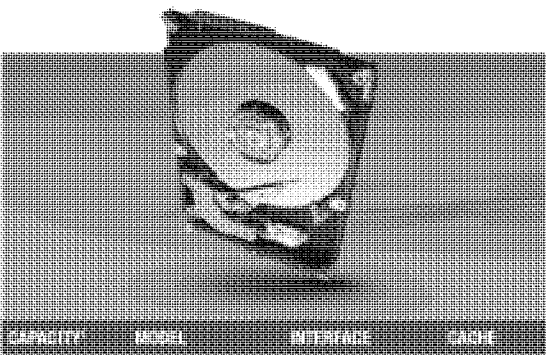
Seagate Pipeline HD drives deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

Key Advantages

- Virtually silent streaming performance as low as 19dB
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes



CAPACITY	MODEL	INTERFACE	CACHE
2TB	ST2000VM003	SATA 3Gb/s	64MB
1.5TB	ST1500VM002	SATA 3Gb/s	64MB
1TB	ST1000VM002	SATA 3Gb/s	64MB
500GB	ST3500312CS	SATA 3Gb/s	8MB
320GB	ST3320311CS	SATA 3Gb/s	8MB
250GB	ST3250312CS	SATA 3Gb/s	8MB

Partner Resources and Benefits

The Seagate Partner Program (SPP) provides access to unique resources and benefits to help channel partners secure new opportunities and grow revenue and profitability.

As a registered SPP member, you enjoy the following exclusive features:

- Password-protected portal
- E-newsletter and regular news updates
- New product evaluation unit program
- Training and sales tools
- Priority support

Start reaping the rewards of SPP membership—register today at [www.seagate.com/partners](http://www.seagate.com/partners)

- Complete the online form.
- Click through and accept our standard agreement.

SV35 Series™

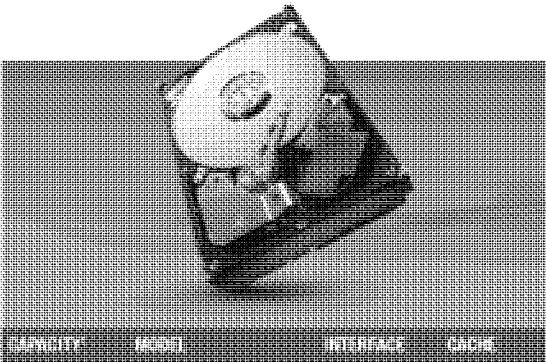
The Seagate SV35 series drives optimize performance, save power and improve reliability for video surveillance applications.

Key Advantages

- Higher areal density for cost-effective DVR applications
- Performance-tuned for seamless video applications
- Enterprise-class reliability for 24x7 video surveillance applications
- Built-in error recovery for non-stop streaming

Best-Fit Applications

- Video surveillance digital video recorder
- Video surveillance network digital video recorder
- Direct-attached JBOD video surveillance storage
- Network-attached JBOD video storage



CAPACITY	MODEL	INTERFACE	CACHE
3TB	ST3000VX000	SATA 6Gb/s	64MB
2TB	ST2000VX000	SATA 6Gb/s	64MB
1TB	ST1000VX000	SATA 6Gb/s	64MB

Service and Support

For information regarding products and services, visit [www.seagate.com/about/contact-us/technical-support](http://www.seagate.com/about/contact-us/technical-support)

Available services include:

- Presales and Technical Support
- Global Support Services telephone numbers and business hours
- Authorized Seagate Service Centers

For information regarding Warranty Support, visit [www.seagate.com/support/warranty-and-returns](http://www.seagate.com/support/warranty-and-returns)

For information regarding Data Recovery Services, visit [services.seagate.com](http://services.seagate.com)

For Seagate OEM and Distribution partner portal, visit [www.seagate.com/partners](http://www.seagate.com/partners)

For Seagate reseller portal, visit [www.seagate.com/partners](http://www.seagate.com/partners)

<sup>1</sup>One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.





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